PROPERTY OF
PRINCETON UNIVERSITY LIBRARY
RECEIVED NOV 23 1937

WORLD PETROLEUM

NEW YORK AND LONDON

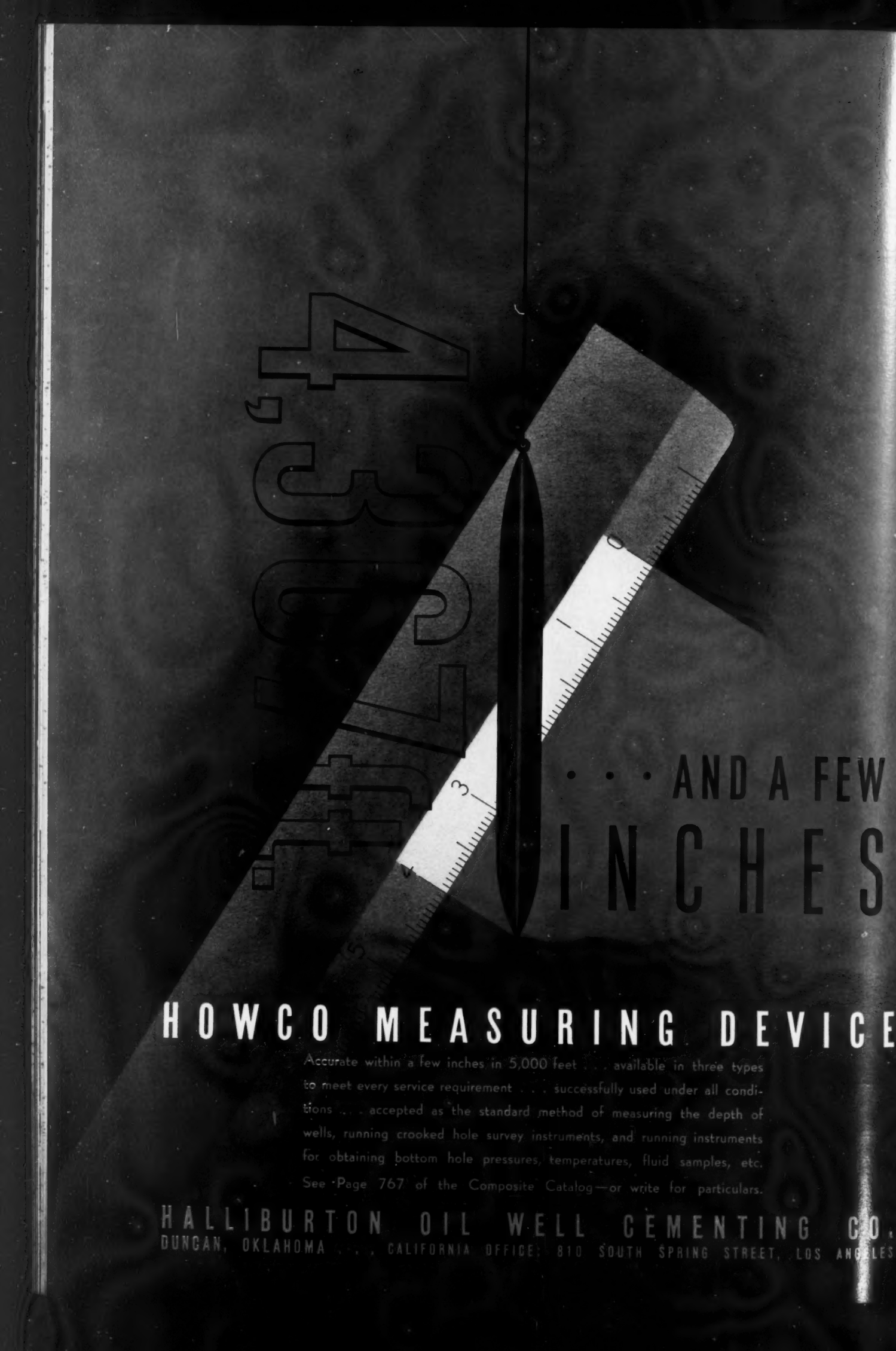
NOVEMBER 1937

SLIGHT CHANGES IN DESIGN OF 1938 AUTOS

BRAZIL IMPORTS 30 PERCENT FROM U. S.

CHINESE INCIDENT AFFECTS JAPANESE CONSUMPTION

OIL LAW RETARDS CUBAN DEVELOPMENT



HOWCO MEASURING DEVICE

Accurate within a few inches in 5,000 feet . . . available in three types to meet every service requirement . . . successfully used under all conditions . . . accepted as the standard method of measuring the depth of wells, running crooked hole survey instruments, and running instruments for obtaining bottom hole pressures, temperatures, fluid samples, etc. See Page 767 of the Composite Catalog—or write for particulars.

HALLIBURTON OIL WELL CEMENTING CO.
DUNCAN, OKLAHOMA . . . CALIFORNIA OFFICE: 810 SOUTH SPRING STREET, LOS ANGELES

WORLD PETROLEUM

RUSSELL PALMER
Publisher

E. W. Mayo
Editor

T. Orchard Lisle
Executive Editor

E. W. Mayo, Jr.
Managing Editor

S. J. Gallay
Advertising Manager

VOLUME VIII | NOVEMBER . 1937 | NUMBER 12

WORLD PETROLEUM
New York: 56 West 45th St.

OTHER OFFICES

London: 3 Savoy Place, Victoria Embankment, W. C. 2

Los Angeles: 412 West 6th Street

San Francisco: 58 Sutter Street

▼

SUBSCRIPTIONS

ANNUAL subscription to WORLD PETROLEUM is offered at the flat rate of five dollars (U. S.) postpaid to any country in the International Postal Union.

For the convenience of subscribers the publisher will accept payment in any of the following currencies at the fixed rate shown below:

Argentina	16 paper dollars
Canada	5.00 dollars
Colombia	5.55 pesos
France	105 francs
Germany	13 reichsmark
Great Britain	1 guinea
Holland	9 guilders
India	1 guinea
Iran	1 guinea
Iraq	1 guinea
Italy	93 lire
Japan	17 yen
Mexico	18 pesos
Peru	19 sol
Poland	26 zloty
Roumania	675 lei
Russia	6 roubles
Venezuela	19 bolivar

Remittances or drafts should be drawn to the order of the Publisher, WORLD PETROLEUM, payable in New York and London.

Subscriber's name and address should be in Roman capitals on the subscription order.

Official position of subscriber is requested.

Advance notice, if possible, of a change of subscriber's address should be given.

CONTENTS

Slight Changes in 1938 Motor Design . 24

Checking Hot Oil Flow in East Texas . 28

Brazil Imports 30 Percent From U. S. . 36

Cuban Exploration Retarded . . . 38

Egyptian Survey 40

Japan and the Chinese Incident . . 42

World Crude Oil Production . . . 43

Foreign Oil Legion 44

Abstracts of World Oil Literature . . 46

Gulf Export Prices 54

Russian Oil Developments . . . 56

AGENCIES

SINGLE copies of WORLD PETROLEUM are obtainable every month, within the delay imposed by the international mail service, at any of the following agencies:

CABIMAS, VENEZUELA—The German Store
CARACAS, VENEZUELA—Casa Letcher, Torres a Madrices 22
MARACAIBO, VENUZUELA—High Life Tailors
THE HAGUE—Martinus Nijhoff, Lange Voorhout 9
LONDON—World Petroleum, 3 Savoy Pl., Victoria Embankment, W. C. 2, telephone: TEMple Bar 1735
A. C. Hardy, 110 Fenchurch St., E. C. 3
W. H. Smith & Sons, Ltd., Moorgate Met. Station
Willing & Co., Ltd., Moorgate Met. Station
Barker & Howard, 6 Fenchurch Buildings, E. C. 3
NEW YORK—Telephone VAnderbilt 3-1095 for list of 20 newsstands carrying copies.
WASHINGTON—Don J. Kirkley, 1065 Wisconsin Ave., N. W.
PARIS—Librarie Brentano, 37 Avenue de l'Opera
PORT OF SPAIN, TRINIDAD—Davidson & Todd, Ltd., 8 Frederick St.
LOS ANGELES—412 West 6th St., telephone: Mutual 1391
SAN FRANCISCO—58 Sutter Street, telephone: Exbrook 4855

The price of monthly copies is 2 shillings in countries of the British Commonwealth and the equivalent of 50 cents (U. S.) elsewhere.

▼

PARTICULAR NOTICES

MANUSCRIPTS and photographs submitted to the editor are received only at the owner's risk. Prompt consideration will be given to them.

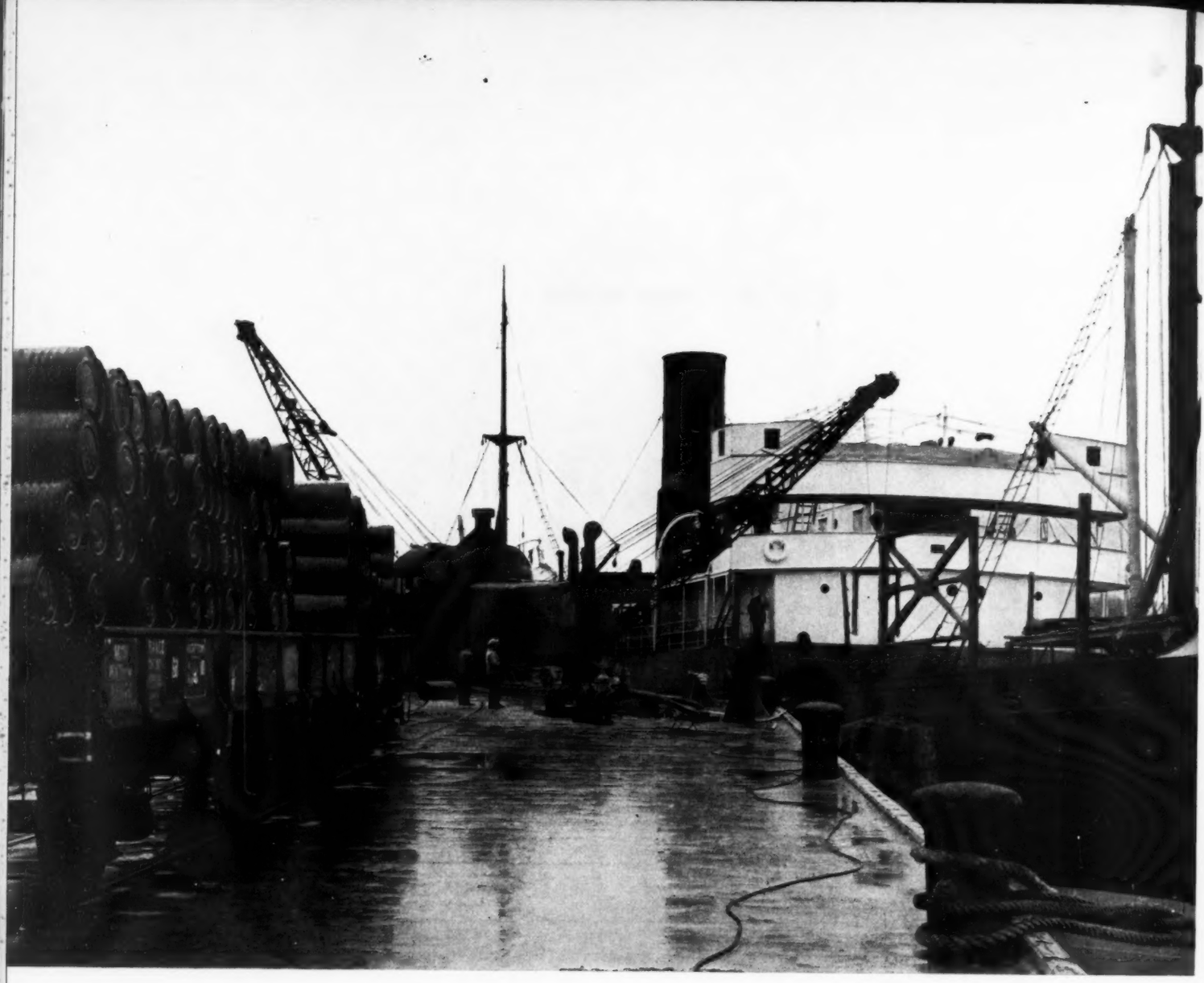
The Publisher does not necessarily endorse the views expressed by authors of signed articles. In the service of readers he will not hesitate to give publication to signed opinions in direct opposition to his own.

Advertising rates obtainable on request.

▼

COPYRIGHT

COPYRIGHT, 1937, by Russell Palmer: contents may not be reproduced without permission.



Loading asphalt at the Port Jerome refinery of Standard Franco-Americaine de Raffinage, France.

EDITORIAL

WHERE TARIFF COUNTERS CONSERVATION

SPEAKING before the Independent Petroleum Association in Houston last month, Secretary of Interior Ickes said:

"The operation of our oil refineries should be kept in step with a sound policy of conservation by obtaining from domestic sources the maximum of the lighter and more valuable petroleum products and from outside sources what we lack of the heavier and less valuable oils."

Preceding this statement the Secretary pointed out that thus far in 1937 the United States had exported 20,000,000 bbl. more and imported 1,000,000 bbl. less of petroleum and its products than in the corresponding period of 1936, that currently the country's exports were nearly three times as large as its imports and that "a relationship of this sort does not help in establishing parity between our oil reserves and those of the rest of the world."

Commenting on the lowering of gasoline yield at American refineries during the past season, the former Oil Administrator suggested that this does not conform to the claim that refineries are engaged in a consistent effort "to increase the ultimate gasoline yield to the theoretical maximum." This last remark appears to be a criticism of the oil industry for adjusting its output to meet the rapidly growing demand for heating oil as well as for motor fuel. Yet the Secretary must have known as well as any member of his audience that the course followed by the oil companies in this respect has been forced upon them by federal legislation.

With the position of Secretary Ickes that a sound policy of conservation for the United States would dictate the utilization of domestic crude for the production of the lighter products while obtaining from outside sources the heavier heating oils we are in full accord. That was in fact the system in operation until five years ago.

In 1932 Congress placed a tariff, under the name of an excise tax, on imported petroleum and products. The result was that the heavy base oil from South America, especially suitable for the production of fuel oil, was diverted from its former course. Instead of coming to the United States for refining, it began to go to Europe directly or via the great refineries located in the Dutch West Indies.

Meanwhile the demand for oil for domestic heating has grown tremendously in the United States reaching an estimated 125,000,000 bbl. for the year 1937 and 96,000,000 bbl. for the six months from November until next April.

With the rise of roundly a cent per gallon which has taken place in the wholesale price of this oil in the American market, its production has become economically as attractive to refiners as the manufacture of gasoline. Aside from any preference that the operators of refineries may feel the American families who have adopted oil for the heating of their homes have done so because it possesses advantages which they are not willing to relinquish. They will be served, and if the policy adopted by the federal government excludes the oil especially suited to this purpose and compels the substitution of domestic light oils which might be more fully utilized for a "superior" use as motor fuel, that weighs not at all with the average householder.

The principal effects of the bill have been to annoy some of the friendly neighbors of the United States to the southward, to add to the heating bills of some million and a half Americans and to turn the country away from a policy that the Secretary of the Interior sets forth as one of sound conservation. It would be more in order for the Secretary to admonish the members of Congress or the chiefs of the administration of which he is a part than to chide members of the oil industry for a condition which they did not create and are powerless to change.

AUTOMOBILE SHOW Reveals Slight Changes in Design

Safety, Comfort and Appearance Show Marked Improvement in 1938 Models, But No Changes in Fuel and Lubricant Specifications Are Indicated.

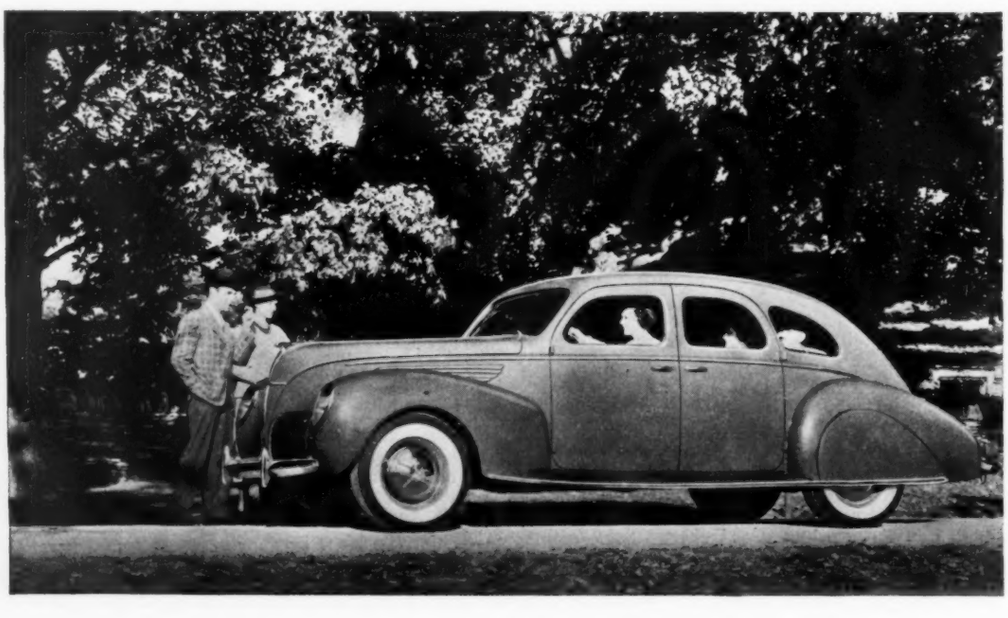
A SURVEY of the 1938 models of American automobiles displayed early in November at the New York Automobile Show discloses a number of features that appeal to motorists who appreciate elegance, comfort, convenience and safety. But except for one particular, and that a not very conspicuous one, the new crop of cars is not distinguished by any notable change in motor design and fuel requirements.

The one exception is a relatively small increase in the compression ratios of some of the engines. Some of the prominent car manufacturers have made no change at all, and in one or two cases have actually reduced the ratios, for structural and material reasons. In other prominent lines there has been an increase of the order of 0.3; that is, where a 1937 six-cylinder engine had a compression ratio of 6.5, the 1938 engine has a ratio of 6.8. The actual ratio varies with the weight and rating of the car and may go as low as 6.0. On the other hand cars that are to be used in regions of high altitude, as around Denver or Salt Lake City, the compression ratio is higher and in some of the new models amounts to 7.1.

Those manufacturers who have raised the compression ratios of their engines have been enabled to do so by improving their ignition arrangements, in one case by the introduction of a new retarder head that has materially improved combustion of the fuel.

No change has been made in the specifications for either fuel or lubricants, which means that the oil industry is not called on to furnish new types of products. All the manufacturers recommend gasoline with octane number of 75 to 80, but in view of the relative scarcity of such grades they provide octane selectors that enable the motorist to get by with a somewhat inferior fuel. The fact is, however, that high compression engines demand high octane gasoline; the new cars will not run efficiently on gasoline that only a few years ago was accepted without question. The accompanying diagram indicates in a general way the average increase in compression ratios since 1929. Prior to that time the supplies of motor fuel were of decidedly poor quality. About 1925 compression ratios of most engines were around 5.3. Meanwhile the consumption of motor fuel was increasing and in the rush to meet the demand the gasoline manufacturers put on the market grades of lowered quality so that compression ratios dropped to 5.2, at which point the curve in the diagram begins. About this time motorists and engine designers began to be knock conscious, largely as a result of the work of Ricardo and Midgely, who demonstrated that to obtain the higher efficiencies that could be had with higher compression ratios the antiknock characteristics of gasoline would have to be improved, and this conclusion was reinforced by the demands of the Army Air Corps. Tetraethyl lead and other antiknock agents appeared on the scene, and compression ratios rapidly rose to 6.3 and 6.5. This has so far proved to be about the limit for the average quality of gasoline available to the average motorist, and further increases that have occurred have been due mostly to improvements in engine design.

The new Lincoln Zephyr, though different in appearance from earlier models, requires no change in fuel or lubricants.



The increase of two or three decimal points in the compression of an automobile engine may not seem to be much to crow about, but it is significant as a forward step in a direction that must ultimately lead to further great improvements in automotive vehicles.

When the compression ratio of an engine is increased it means that more fuel and air, and hence more power, is packed into the cylinder. In proportion as the engine is thus enabled to deliver more power it can be made smaller. Compare, for instance, the low compression models of 1910 with the high compression models of today; in 1910 a 50-H.P. automobile engine weighed 888 lbs. with crank case, whereas some modern 80-H.P. engines weigh only 300 lbs. with crank case.

Since car manufacturers find that high compression ratios enable them to build smaller but more powerful engines, it might

New Dodge in unique settings. Important advances in automobile efficiency will be achieved when 95-100 octane motor fuels are available at a price that the average motorist will be willing to pay.

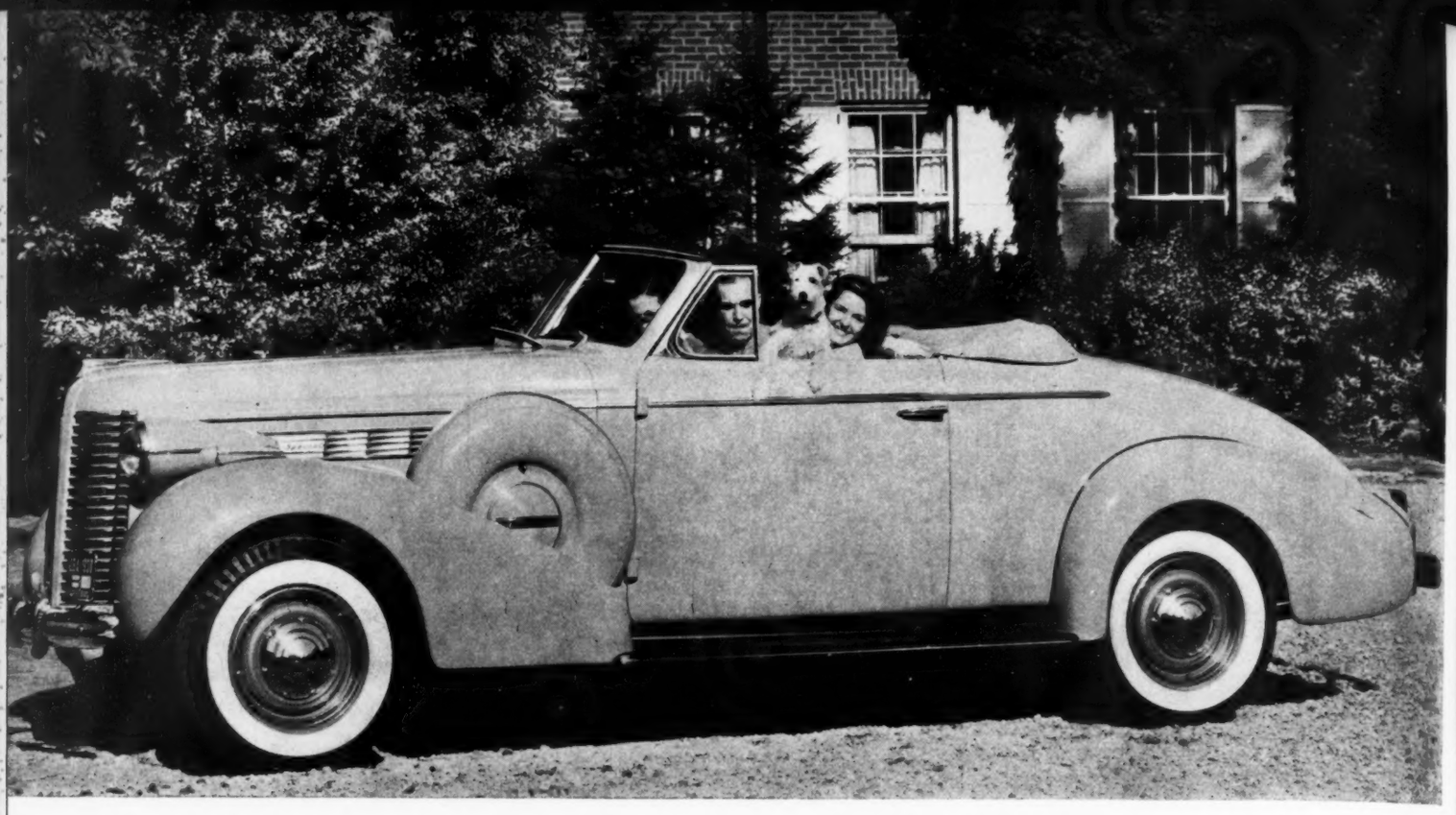
be asked why should they stop with a ratio of 6.8? Why not give the 7.2 engine, built for dwellers in the high lands, also to the lowlanders?

If a 7.2 car built for Denver, where the air is thin, was brought to New York the operator would quickly notice the difference in a heavy knocking and fouling of the cylinders with carbon, even though he uses exactly the same medium grade gasoline. Give him a gasoline of 80 plus octane and there will be much less complaint from the engine. The point is that a ratio of 7.2 for cars operating at about sea level requires a much better grade of gasoline than the oil industry is furnishing at what motorists regard as a bargain price.

The net result is that the automobile engine designer is practically stymied. He would gladly arrange for a higher compression, but what's the use? There is plenty of reason. The average motorist is not yet prepared to pay for 80 or 90 octane gasoline (anyhow, there is not yet enough of it for all motorists) and if the attempt is made to apply a higher compression to the average quality of gasoline the result is distinctly unsatisfactory. So the engine designer improves his retarder head and other appurtenances of his ignition system to the best of his ability in order to get as much power as possible out of the gasoline which his clients have to buy.

What would the automobile engine designer do if high octane gasoline were generally available at a low cost? We have only to look at what the designers of aviation engines are doing. In the aviation field the engine builders are confronted by two musts. There must be an abundance of power, and the engine must weigh as little as possible. A maximum of explosive force must be packed into cylinders of minimum dimensions, and both rquirements have been rather handsomely met. The increase of horse power in proportion to engine weight in airplanes has been carried to the point where some 1000 h.p. airplane engines deliver one horse power for every 1.23 lbs. of engine weight, as compared with one horse power for each 4.85 lbs. in aviation engines converted from the automobile type. The reason why the aviation engine designers have been able to make their engines both smaller and more powerful is that aviation interests are able and even anxious to buy gasoline of the highest possible octane rating; hence their engine builders do not hesitate to use compression ratios that the designers of automobile engines cannot yet allow themselves to contemplate. No transcontinental or transoceanic air line, no military aviation service, no explorer undertaking a long flight over arctic wastes, and no contender for the honor of driving an automobile faster than the existing record of 301 miles an hour would think of employing a low compression engine or a gasoline of less than 80 octane, preferably 90.

As would be expected, most of the impetus toward the use of high octane fuel in aviation originated with the U.S. Army Air Corps; above anything else military aviation demands maximum power and minimum weight. In 1928 the Army Air Corps pointedly called the attention of the petroleum industry to the antiknock value of aviation fuel, and issued specifications requiring its gasoline to rate about 87 octane value. After adopting these new

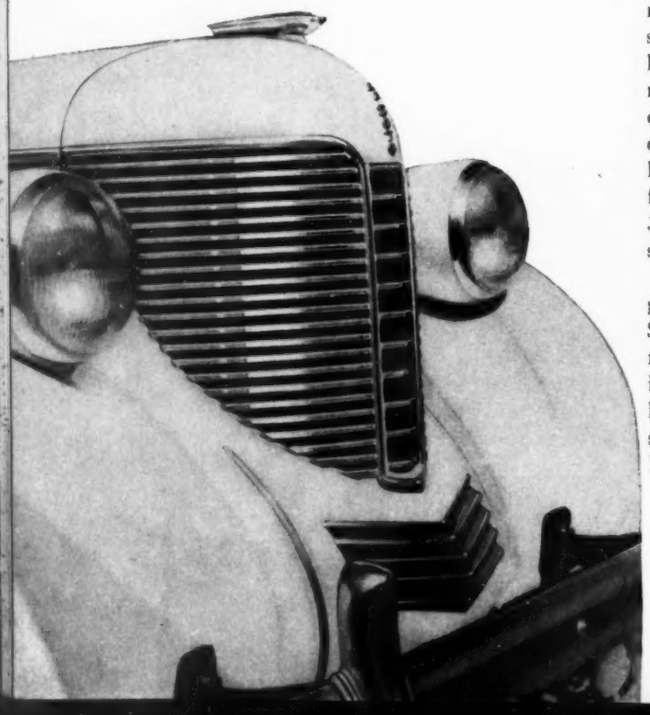


Above, Buick convertible coupe for 1938 and right, Chevrolet Master Sedan, both models embodying safety, comfort and improved appearance.

specifications the Army developed about a third more horse power per cubic inch of piston displacement. Just how far the United States Army Air Corps has gone in combining high compression ratios with high octane gasoline is still of the nature of a military secret but it is known that its new bombers are powered with two 1000 h.p. supercharged engines.

The progress effected by the military aviators stimulated the interest of the commercial aviation companies in gasoline of standardized antiknock quality. The result has been that the whole aircraft industry now has gasoline ranging from 75 to 87 octane number. It has been possible to develop fuel of 100 octane value and even higher, and with 100 octane fuel it has been found practicable to develop from 15 to 30 percent more power with engines of the same size and the same compression ratio.

The modernistic bonnet of the 1938 De Soto. The radiator grille is made up of chromium bars.



This interest in antiknock aviation gasoline has not been confined to the United States but it is generally insisted on by military services and commercial aviation interests everywhere, and these interests have strong inclinations to revise their specifications upwards. For instance, the Royal Dutch Air Lines and Swiss Air require 95 octane value for the best types of fuel used by them.

The existence of such a market for high octane fuel has stimulated the research departments of leading refining companies to intensive research on the problem of improving the antiknock quality of commercial gasoline for automobiles. The nub of the problem is not so much how to make high octane gasoline but how to make it cheaply enough. The petroleum chemists are well acquainted with isooctane, which rates 100 octane and is in fact the standard hydrocarbon by which octane ratings are established. Only a few years ago isooctane cost $28 a gallon and even today it costs nearly a dollar. However, it is possible to produce a gasoline of even better than

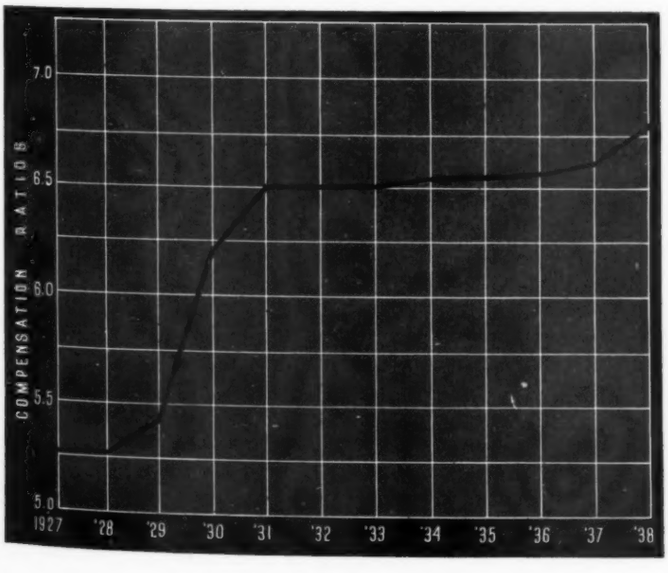
De Soto's acceleration is improved by changes in design of the camshaft.

100 octane by making blends of certain choice cracking products, antiknock agents such as tetraethyl lead, and synthetic or polymerized products made from refinery gases.

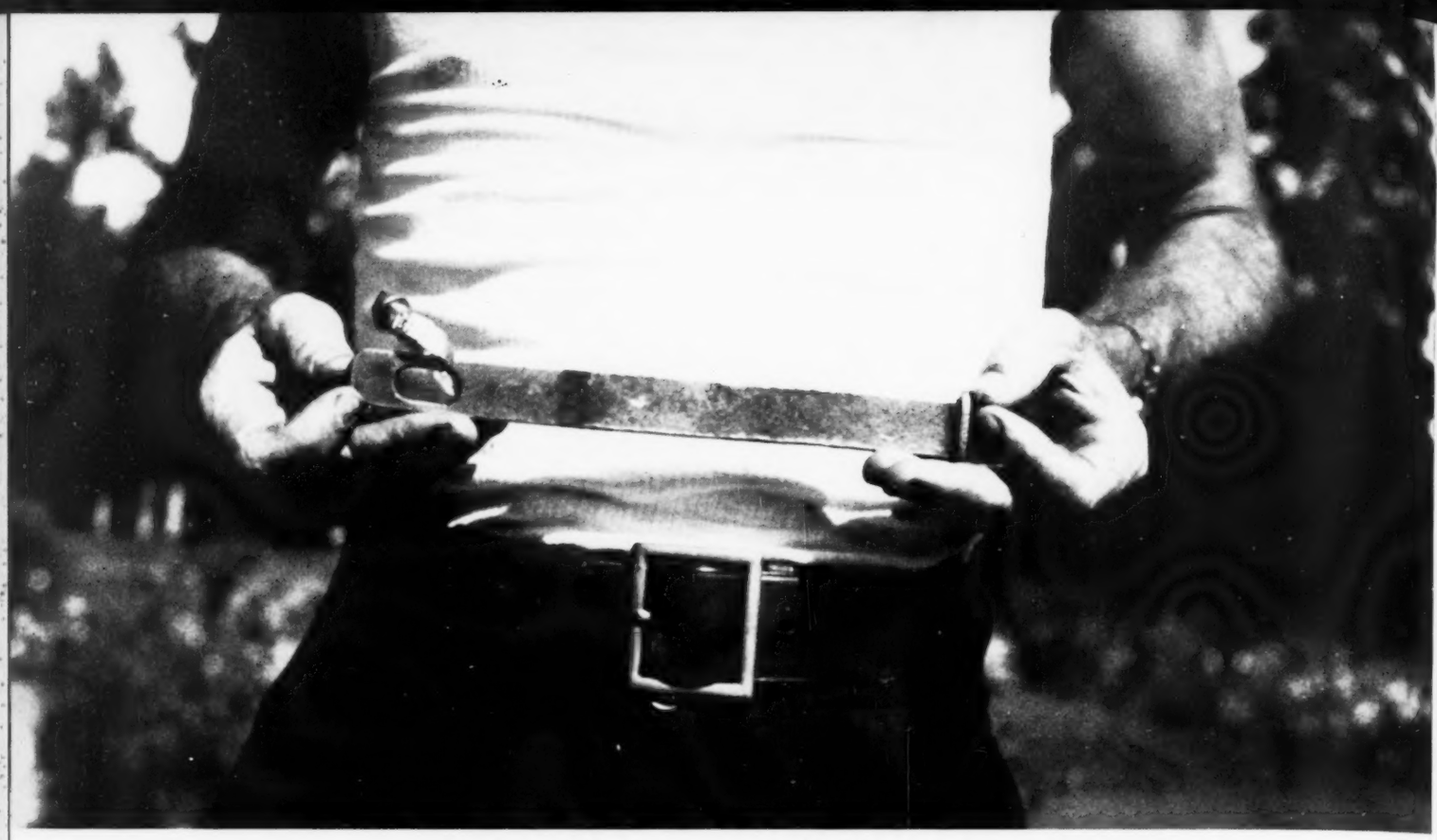
One of these new blending agents is isopropyl ether, which of itself has a blending value slightly better than pure isooctane, and it now appears that this material offers the most readily available means for a general raising of the octane ratings of commercial gasolines. The question is now mainly one of the extent of supply and cost of manufacture.

A recent survey of potential supplies of propylene, the raw material for making isopropyl ether, has shown that in the United States there is a supply that will be sufficient to produce at the present time approximately 340,000,000 gal. of technical isopropyl ether, exclusive of all other normal demands for other purposes. Assuming that 100 octane fuel is required (using 3 cc of tetraethyl lead per gallon) this amount of isopropyl ether is sufficient to produce some 850,000,000 gal. per year of finished product. At the present time the total consumption of aviation fuels of all grades in the United States is not far from 90,000,000 gal. From this it is apparent that when the visible supply of propylene has been worked into isopropyl ether there will be available some 750,000,000 gal. of 100 octane fuel for the general motorist trade, even after the peace time demands of aviation have been met. When this supply is combined with the available supplies of technical isooctane, estimated at 155,000,000 gal. a year, there is every prospect that quantities will be available to cover nearly all conceivable demands. And there is also excellent prospect that when large scale production of 100 octane gasoline is well begun the price will be reasonable, in the sense that if not as low as the price of ordinary 70-72 octane gasoline it will still be within the reach of a majority of motorists.

The implication of all this is that low octane motor fuel is on the way out. The day when straight run gasoline could be sold to discriminating motorists appears to be about over. Cracked gasoline now has the preference because of its greater octane value and a freedom from gumming that has been conferred on it by the invention of inhibitors. But even the best of cracked gasolines rate below the mark that far seeing engine builders are aiming at; his mark is a small supercharged engine working on 100 plus octane fuel. Cracking alone will not reach the goal, although if further improved it will be relied on to furnish the base with which to blend the superior products now in prospect from the new synthetic and polymerization processes. The questions of cost and price still have to be settled to the satisfaction of motorists, but once it has been proved that a demand exists enterprising manufacturers generally find a way to meet it.



Compression ratios of average automobile for the past 10 years. Prior to 1927 the possibilities of higher compression ratios were unrealized because no method had been evolved to prevent knocking. With the use of tetraethyl lead and higher octane gasolines a sharp rise in compression ratios is noticeable.



Legerdemain of the leases—passing a seal band through an apparently solid steel dart of the type used to lock flow line stopcocks in the desired position.

CHECKING HOT OIL Flow in East Texas

By Elton Sterrett

WHAT is the difference between crude oil and a rabbit, or a black bass?

"None," decreed the courts, and stuck to their decision. For, based on the legal idea of "capture," crude petroleum stored by nature below the surface of a given field partook of the characteristics of wild life above ground in the same locality. Either became the lawful property of the man who, duly licensed by the state, was able to capture, take or otherwise gain physical possession of the "game". So deeply inculcated was this idea of capture of something possessing the ability to escape that old oil laws were modeled upon, if not actually copied verbatim from, statutes controlling the hunting of animate game.

Faced with this traditional aspect of crude, the Texas Railroad Commission at the outset of its battle against hot oil in the vast East Texas field found itself in much the position of a farmer's small son, unaided and unarmed, attempting to stay the foraging of an army of grown men, behind whom stood the shadowy majesty of the courts bidding them proceed, disregarding or overriding the protests of the owner —so long as they complied with the laws regarding license, permit to drill, and pollution of streams.

Defined as "oil produced in excess of the allowable as fixed by the Texas Railroad Commission," the flood of hot oil released by greedy lease owners and producers during 1933 and 1934 far surpassed on occasion, and during the period frequently averaged, the stupendous total of over 200,000 bbl. of oil per day.

In the beginning of its campaign of education for lease-holders, land owners, producers and users, the Railroad Commission found itself rigidly restricted to the control of "petroleum", as stated and set forth in the acts of the Texas Legislature empowering the Commission to proceed with the conservation of Texas' greatest natural resource.

With the shrewdest legal talent in the country attracted by the large fees and possibilities involved in participation in the struggle to obtain immediate control of the vast field's resources, it was not long before the producers found a loophole: let the crude be processed, ever so slightly, and under the law it then became a "petroleum product", and as such was unaffected by provisions of the conservation laws. So, almost between dusk and dawn, the number of refineries in the East Texas field jumped to a total of 84, all processing the crude by skimming it slightly, which removed the residue beyond the jurisdiction of the Commission and left it free for unrestricted transportation.

Realizing early in the struggle that the flood of oil could not be controlled at each and every one of the thousands of producing wells without an army of men in constant attendance, the Commission centered its effort on the checking first of pipeline runs and then, after much time spent in educating the legislature and the petroleum industry in the benefits to be expected, the Commission was able to cut off the flow of these technically "refined" petroleum products by any and all of the three transportation means available: rail, pipeline, and motor truck.

That the entire area of the field, approximately 124,000 acres, yielded hot oil is a gross exaggeration, though it was possible to unearth cases of evasion at spots so widely scattered that it was necessary to include the entire area in the campaign against the disregard of the rights of others.

With a force of only 24 paid inspectors actually working in the field to trace down violations, throttling the loss was a stupendous task, even after the legislature had revised and changed earlier conserva-

tion laws to enable the Commission to make its orders hold good after being reviewed in state and federal courts and actually to cut off and padlock wells violating the restrictions.

As in other forms of police or regulatory activity, many illegal methods for running oil were uncovered through skilful detective work; another large percentage was traced through tips from adjoining landowners or leaseholders who saw their own rights being trampled by the unbridled flow of oil from a neighboring well, while their own units were held strictly to the Commission's allowable. Still other crooked devices were found by luck.

THE WEAK SPOT IN A SEALING SYSTEM

An example of the part played by Lady Luck is illustrated by the dart subterfuge. A certain lease was alleged to be running more than its share of oil, as was irately protested by the law-abiding leaseholder adjacent, and as was determined experimentally by the fact that the above-ground connections on the wells under suspicion became far hotter than did others nearby through which only the strict daily allowable was flowed. The flow lines on these wells were cut off, as was customary, by stopcocks, held in either open or closed position by a heavy steel bar, known as a dart, being passed through body and plug and either padlocked or sealed in position.

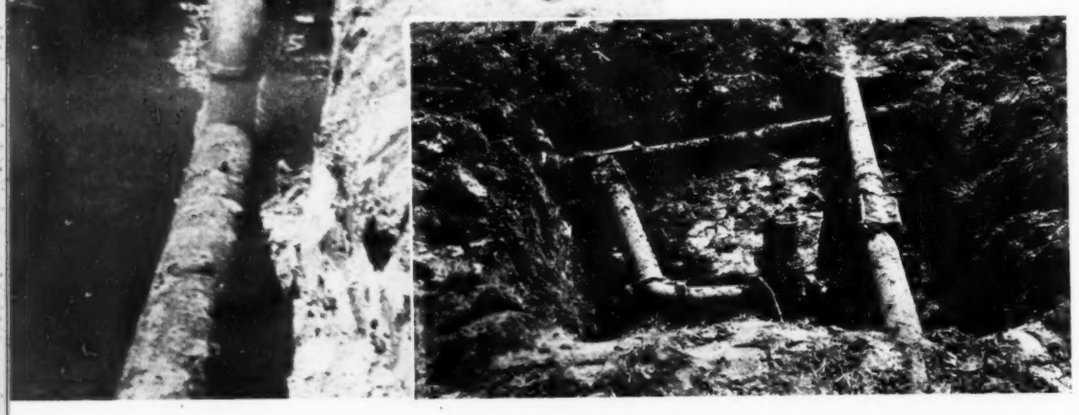
In the work of the Railroad Commission sealing was adopted as the usual manner of officially registering a valve's position, and the seals on these valves were regularly found intact—seemingly giving the lie direct to the irate neighbor. Idly suspending one such dart on a key thrust through the seal aperture on one of his surprise visits, the inspector took out his knife and tapped the steel. There was a metallic quality to the usually mellow tone. Investigation which followed proved that one side of the dart had been sawed through near the inner curve of the oblong slot, and then the end lightly peened with a hammer to bring the edges of the saw cut into contact.

When paraffin-covered, as was customary on all pipe fittings at a well frequently flowed, enough paraffin was available to rub into and mask the cut completely yet still leave it possible, simply by inserting a screwdriver or pliers leg into the slot, to spring the gap wide enough to allow the seal—undisturbed and its band unmarred—to be slipped free through the crack thus opened. The dart could then be pulled, the cock turned to allow hot oil to be run, and the dart replaced and seal put back until the next manipulation of the line was desired.

Many variations on the cleft dart idea were thought out by mechanically alert

The length of pipe slipped over the nearest gate stem and padlocked there may be removed simply by proper pressure on the spring controlled end of the stuffing box stud.

Gradually diverging from the main or tapped line, this illegal by-pass is designed and constructed so as to fool any but the most expert doodle-bug operator —a definite contrast with that shown below.



Such a hook-up gives a pronounced change in signal within the ear-phones of the electrical finder, and relies solely on the vast area of the oilfield to escape detection.

hot oil runners, one change being to saw off the headed end, tap into the stem and screw in a short stud, likewise drilling and tapping the short head section so that, screwed together, the dart appeared unimpaired, but from which the removable head might be unscrewed to permit illegal use of the valve to be made. One lease was even found on which the switcher had whittled out and realistically painted wooden darts to replace the usual steel ones, simply splitting the end with a razor blade and allowing the seal band to be slipped free, as with the cleft dart illustrated.

Mythical left-handed monkey wrenches, long a favorite object of search for gullible machine shop apprentices, found an actual counterpart in left-handed valves: that is, those in which the normal direction of rotation of the handwheel to close is counterclockwise. That such valves are made, however, simplified the problem of getting away with many thousands of barrels of crude oil for certain producers. Simply by removing the manufacturer's handwheels, carrying the customary arrows cast onto the rim of the wheel to show the proper direction of rotation for opening, and substituting therefor the handwheels from right-handed valves, the tricky leaseholders dodged the letter of law evasion.

When the Commission's inspector spun the valve in the direction indicated by the arrows on the handwheel and sealed it at the position where it refused to rotate further, he was not locking the line closed, as he thought, but actually placing the state seal on a valve aligned to carry away hot crude.

The fact that much illegally produced oil was physically hot as well as legally torrid spoiled this dodge, as it did many others. The prime requisite of illegal producing was to run the oil as quickly as possible, and to get it immediately into a refinery or pipeline before an inspector could happen along. This same oil, fresh from a well, emerged above ground at a temperature ranging 20 to 60 deg. higher than that of the atmosphere, and thus heated the pipe to the point where the variation in pipe or fitting temperature could be checked by mere hand contact. This much proved, it was necessary only to take out the valve parts from their cage to detect the reverse thread on the stem—and to padlock the lease.

COLOR CHANGES RAISE A HUE AND CRY

One producer, a Mr. Blankenship, strictly honest and law-abiding, had little patience with the repeated protests of an adjoining leaseholder that Blankenship's wells were exceeding their allowable, especially after neither Blankenship nor the Commission's inspectors could detect anything wrong with the way the wells were being flowed by the switcher.

And, being a just man, Blankenship would not discharge the accused leasetender without definite proof of his disloyalty. Through an automobile accident an apparently unrelated fact was discovered: the man was color-blind. A week later he was called into the office and given a new box of bull plugs, with the explanation that one was to go on each well, there to replace a welded-up fitting which had been condemned as unsafe.

The new plugs were painted a bright green, replacing fittings of the same color in the original hook-up. Only a week after the job of installing replacements was completed, the switcher was again summoned to the office, and asked to explain why No. 2 well had flowed four hours on Monday, No. 7 a like period on Thursday, while at the same time No. 3 had also been producing.

Although the man vehemently and profanely denied flowing the wells, his expression as the different wells were specified was ample admission of guilt. The new bull plugs had been painted with a special heat-indicating pigment, its color changing from green to brown at a temperature of 125 deg. F.—a temperature not reached by the wellhead fittings when flowing the legal allowable at the proper rate, but which value was exceeded with the consequent change in color when a well was allowed to run for a longer time.

Similarly, another company detected the use of one of its tanks for illegal flowing of certain wells by repainting the firm name on the tanks and using this time a heat-resisting paint for making the periods in the lettering. These circles of paint, some four inches in diameter, were like Mr. Blankenship's bull plugs watched with a telescope from a shaded window in the main office and the times of color changes noted.

In this latter case the use of the indicating paint showed which tank was being used for the hot oil run and, although there was a scant four-inch layer of b.s. on the bottom, it was decided to clean the tank. Although not shown on original drawings or

on the piping layout, a connection was found in the tank bottom, and leading out from it a line which, when traced, was found to extend more than a mile and a half to a refinery.

The tank bottom opening, located as far as possible from the gauging hatches, was controlled by a flat, paraffin-covered float which automatically lifted the valve flap when the tank contained more than five feet of oil, final control of outflow being effected solely by the man at the refinery with a valve on his delivery line there.

Combination of flow from a tank on which all (known) connections were doubly sealed and padlocked, and around which nobody was observed at time of flowing, made this by-pass an especially difficult one to run down and eliminate. Similar hook-ups at other tank batteries in the field were not discovered until changes in ownership of the lease rendered it desirable to remove or rebuild the original tanks.

CONTROLLED STATIC AS AN AID TO THE INSPECTOR

The radio or electrical by-pass finder, familiarly known by field investigators and Commission inspectors as a "doodle-bug", has been of great value in tracing out illegal connections; especially in locations where there are not too many intersecting or crossing lines. In the hands of a man experienced in interpreting the change in sound emitted by the device, it is possible to follow a buried half-inch water line as easily as a 16-in gas main, and to determine accurately the presence of any diverging line or tap.

As with any other type of protective device, the working of the doodle-bug speedily became known to the hot oil runners, and provisions made by them to render its tone unbroken even at the exact point of tapping a line. One method of accomplishing this was to use rubber hose for the actual junction; but, due to the rapidity with which ordinary rubber products are softened by crude oil, leakage soon developed at the joint which, working up through the comparatively loose earth backfilled over the line, was spotted by the line-walker and the illegal tap uncovered.

The new line thus spotted, it was mere routine operation to set up the radio circuit thereon, and with the instrument to run it down to the premises of the receiver of the hot oil. In some instances, so thoroughly had the job been done, the junction of the by-pass line to other—and mapped—lines of the receiver was also insulated so that nothing amiss would show up were these known lines given a routine check with the electric pipeline finder.

Where gravity flow from well battery into field gathering lines was possible, these rubber insulated joints were, in at least one instance, encased with a concrete pipe support to prevent leakage. So effective was this device that even after the flow of crude within the rubber had completely broken down the inner layers of material and left a spongy mass through which oil could percolate rapidly, the concrete cast around it provided adequate seal.

Thorough appreciation of the limitations of the human ear was shown in one illegal tie-in, in which a tap was made from one major company's flow line and carried to a connection with another pipeline which, formerly legitimate in every respect, had passed through a number of ownership changes, finally coming into the possession of a refinery which utilized it for supplementing its meagre purchases of legally produced crude.

Although the two lines in question crossed at approximately right angles, the usual method of a short connection was not used. Instead, trenching far down the major company's line, a riser was welded in and a line brought out and laid so as to veer gradually away from the tapped main. So gradual was this change in direction that the variation in note of the doodle-bug was passed unnoted through a number of carefully conducted tests over the exact pipeline site. As the main overlaid the smaller pipe to the refinery, there was nothing at the point of crossing to mark the line as having been in any way changed since the original survey was run.

Eventual discovery of this scheme came about through repeated complaints that a certain lease, owned and operated by a reliable major company, was running more than its allowable oil. When these complaints were supported by bottom-hole pressure drop in the vicinity, a force was put to work excavating the main line at selected spots, at which points the line could be checked for excessive temperature changes. One of these spots chanced to find both lines only a short distance away from the tie-in, after which digging out of the entire hook-up was easy.

In contrast to this carefully worked out scheme is another instance illustrated, where a by-pass line struck off boldly at right angles to the line it was to rob, turned quickly, and tied in with the second line. This hook-up was, of course, readily discerned upon traversing the suspected district with the radio finder.

Cutting into and welding onto a line nearly always involved the wastage of some oil, and even if it was carefully burned on or near the site of illegal entry, some traces of oily dirt or of scorched and parched ground remained to attract the trained eye of the Commission inspector or the company investigator—one such tie-in, discovered before it had flowed a barrel of oil, being detected by a coating of soot on some trees nearby.

This discovery was made although the actual earth disturbance had been neatly camouflaged by choosing a point where a brush pile had long lain, a haven for snakes and a point to be avoided by the wary line-walkers. The trash, carefully removed during the tapping job, was again in place when the inspector made his next round and, but for the smudge on the tree with no visible ash to account for it, might have long remained undisturbed. When the by-pass was uncovered and cut out, the interior of the pipe was dry and caked with hardened paraffin, indicating that the oil lost had been burned in the same pit in which the tie-in was made.

Activity of any kind around a lease already developed, such as the digging of trenches, the presence of lights—in numbers—on a dark night, or even the sudden burning of gas flares on a lease known to be connected in to one of the field's many natural gasoline plants was ample tip to the Commission that all was not as it should be. As with other illegal acts of producers, word of these deviations from normal routine often came from neighbors, fearful lest a new outlet for oil adjoining their property to be opened and their own sands thus drained of their rightful crude.

A small valve on a hook-up such as in the foreground may be turned below ground in wet soil—by-passing thousands of barrels of crude per day.

In practically every case of illegal oil running unearthed by the Commission's activity, the offenders have been the smaller fry, independent producers selling where they could, or supplying crude to their own refineries. One such independent, owning the land in fee on which his wells were drilled, reported to the inspector in his district that a neighboring lease was being plowed up. Not only that, but the bare clay land with a thin three-inch layer of worn out soil atop hard red clay, was being sub-soiled.

TAME OATS BETRAY WILD OIL

An investigation was promptly made—no tip, however barren of possibilities it appeared, was passed up—and the lease owner was watched while he proceeded with the contouring of his land, terracing it properly against erosion and throwing up water diversion dikes with his tractor as though his living depended upon what was produced above, rather than what came from below, the surface.

One dark night the tractor rumbled down the road, returning late and, according to the adjoining independent, chugging as though barely able to manage its load. Early the next morning, however, it was again in the field, discing the beds and turning under a liberal application of cotton-seed meal. Planting followed, and in due time a green mat of oat spears sprang up to hide the bare earth.

About this time a check made on the neighbor's lease showed that the bottom-hole pressure there had suddenly dropped, testing far below the average for that portion of the field. Since the proper bottom-hole pressure could be arrived at by computing the amount of allowable oil flowed since last being checked, the variation showed that somewhere in the vicinity a large amount of hot oil was being with-drawn.

Attention was naturally directed to the adjoining property, but nothing suspicious appeared there, and there were no grounds for invading the property and beginning an indiscriminate digging campaign on the off chance of unearthing a by-pass. Here, again, the temperature of the oil being run gave away the scheme. Across the waving field of green appeared a snaky brown streak, parallelling and only two furrows away from one of the contour dikes.

Shovels soon disclosed the reason. Threading one of the subsoil furrows was a two-inch galvanized line, buried by backfilling with the tractor; this work being quickly masked by an early morning round with the disc harrows. This same haste to hide the line gave it away, as it lay so near the surface that the heat given off by the oil in the pipe dried the ground above it and killed the crop which was being grown to mask it.

Investigation further disclosed that the man had done nothing but make the actual tie-in of the pipe on his own land. The 1,200 ft. of pipe extending from his lease tank battery flow header to a nearby pipeline had been stolen bodily from an unused water line—laid on and left lying above ground—which had been cut with a hacksaw and the desired section dragged in by the tractor in one piece the night the heavy chugging was noted.

Because there were no actual witnesses to any of the moves made by the man in making his tie-in nor to the running of hot oil through the line after it was installed, the only penalty assessed was a $25 fine—added to which the Commission's inspectors maintained an unremitting watch on the lease from then on.

BY-PASSES, LIKE GOLD MINES, ARE SOMETIMES SALTED

Attention to detail, the seeing and filing away in memory of minute things which would pass unnoticed by any but a trained investigator resulted in discovering many taps which might otherwise have lived a long and—for their devisers—prosperous existence. One such was the frequent appearance of a wet spot inside the earthen fire wall surrounding a certain lease tank battery.

Since the drain line from the bottom of the tanks ended in a most natural appearing depression at the edge of this wet spot, it merely appeared as though the switcher was being unusually careful to keep water produced by wells under his charge drained out of the tankage. Not only was the spot damp, but the moist earth also tasted salty—was salty—as demonstrated by a small sample surreptitiously carried away by the inspector and laboratory tested for salinity.

Checking of the lease records showed no claim for increase in allowable for volume of salt water produced, which was in itself suspicious, as with well allowables being steadily cut down as more and more wells were brought in, every legal loophole admitting more oil was avidly used. When this information was checked against the reported completion depths of wells on this lease, all clearly cased and drawing oil above the water level for that portion of the field, a closer watch was kept on the switcher's actions.

At last he was caught inside the fire walls, exactly at the spot where the recurring dampness had been noted, in the act of emptying an ice-cream freezer tub. His explanation was logical enough—he didn't want to pour the salt water where it could affect the soil around his house or possibly wash off into a stream, and what better place could be found than inside the fire wall, where all waste water produced with the oil was confined until evaporated?

A survey with a doodle-bug followed, there being no change in note emitted save such as might be expected by the greater mass of metal in the flow-line check-valve. The main gate was properly padlocked and sealed; the record of seals being carefully checked and found to agree with scheduled and observed emptyings of the lease tanks. Finally a shovel was brought and the legitimate by-pass around the check-valve unearthed—this device being to rid the check of entrapped air which, if left in the line, would effectively stop grav-

A concrete pipe support may effectively conceal the tie-in of a vertical tap as well as sustain the legitimate lines appearing in such a connection pit.

ity flow. Also, though not shown on the plan of lease piping, there was a tie-in from the farther or up-stream elbow of the legitimate by-pass which permitted the same valve to release oil from the tank flow line when apparently closed in by the locked and sealed gate.

The buried valve wheel was turned, below the surface of the soil, with a forked handle which was thrust into the wet ground to engage the spider of the wheel—all traces of this disturbance being effectively hidden by pouring a bucketful of water onto the sandy soil after each unauthorized manipulation of the gate.

Another of the instances where Lady Luck stepped in to clear up the mysterious flowing of oil occurred at one of the last of the serious leaks, when the daily loss had been cut to some 10,000 bbl., and the official checkers were able to concentrate on the comparatively few remaining suspects or open violators.

The pipeline to one of these suspected refineries passed through one of the large open pits in which excess oil had been stored when pipelines and other outlets had been closed against it. Three other lines were also known to traverse this pit—regarding which there was a strong suspicion that the dam impounding the oil had been thrown up at that point to take advantage of the numerous pipelines which the pool of oil would cover.

Running a routine check over the refinery's pipeline one day, the operator of the doodle-bug trudged wearily around the ill-smelling body of oil, swinging wide of the shoreline to avoid slime and paraffin muck deposited there, and suddenly was surprised to hear his earphones come alive again. A quick survey of his position showed he was a good 40 ft. from the nearest authorized line, though prodding of the ground directly underfoot seemed to reveal a less firmly knit standing there than in the surrounding terrain.

Shovel work soon uncovered an unmapped three-inch line, shielded throughout its distance with a supposedly radio-proof sheath of corrugated iron, bent to fit over the line, and supported a good six inches above it by an intervening layer of earth.

Traced to the oil pool in one direction, where it indubitably joined the refinery main, the line led outwardly for a quarter of a mile to an old burning pit where it made adequate pipeline but no electrical connection through rubber hose with one of a major company's lines which also passed through the same open storage pool.

Only through the chance of the man carrying his doodle-bug tuned in and with the earphones attached on the detour around the pool led to this find, as all known lines entering and leaving the oil body had been checked numerous times without any connection being discovered.

WHERE IGNORANCE WAS NO OUT

Two-inch pipe formed the majority of by-pass lines uncovered, this size being widely used throughout the field for gas, water and individual flow lines in legitimate channels. Hot oil runners favored this pipe as being easily handled and installed with a minimum crew and requiring only a narrow trench which may dodge natural obstacles such as trees and big rocks and these same obstructions were later used for shaping the pipe to fit the crooked ditch. Pipe of this size, carrying 100 bbl. per hour, or 2,400 bbl. per day, has a pressure drop of 18.4 lb. per 100 ft.—a negligible loss when but a short tie-in section of perhaps 20 ft. is required.

The amount of pressure required or dissipated to force this oil through the short tie-in is therefore less than four pounds—a value represented by or scarcely exceeding the width of the graduation marks on the average oilfield gauge. Pressure indications, consequently, proved of little or no value in running down illegal tie-ins; unless the hot oil runner chanced to incorporate in his line-up some intermittently active line with a recording gauge, which would then show sporadic pressure on the line at times when none was authorized or expected.

One major company's eight-inch line was thus used for handling excess crude run by one of its switchers who happened to be connected—financially—with a nearby refinery superintendent. In fact, nearly every time that switcher dropped in at the refinery he was cordially welcomed, and handed a cigarette which, if a Lucky Strike, he was careful not to smoke. In fact, on one occasion in the refinery office, he was tendered a cigarette of that brand at the instant a Commission inspector entered and, though inspector and superintendent both lit up, the switcher refused to join them, finally tucking the tailor-made into his pocket and rolling himself a hand-made smoke.

Not until the man reached the seclusion of his cabin on the lease did he fish out the cigarette, and with a pencil point dig out the tobacco in one end. Then, pushing with the pencil against the other end, a few more grains of the weed fell out, followed by a tightly rolled green cylinder which—as he expected—proved to be just another hundred-dollar bill.

Thinking over the switcher's peculiar action in the refinery office, the inspector made it convenient to check the major company's lease frequently and to prove eventually through bottom-hole pressure determinations, that more than the rated allowable was being taken somewhere.

Confronting the company officials with his conclusions, he was instantly met with the offer of the services of the pipeline gang if he would only indicate the spot whereon to dig. Mindful of the earlier instance where a brushwood heap had masked a connection, the gang was set to work where branches, lopped from a fallen pine, had long lain in a pile.

Almost at once, and actually showing above the surface at one end, was found a Dresser coupling, which stoutly resisted when a pry-bar was inserted under it. Further digging brought to light a by-pass, both ends of which were connected by means of saddles. These fittings are especial favorites with hot oil runners, as they may be fitted with nipples and gate valves, clamped in place, and a drill run through them to tap the desired line even under pump pressure without there being any loss of oil to betray the illicit activity.

Strangely, both the major company and the refinery to whose line the short by-pass was also saddled denied knowing anything about the hook-up. Even when purchase of the two-gate valves used for the tie-in was traced to the major company was its local management emphatic in denying any knowledge, permission, or even suspicion of the line.

So well hidden was the participation of any certain person with the device as un-

covered that it was not until the switcher chose to give up his job and the refinery superintendent changed to another position, this time with a firm outside the hot oil sector of the East Texas field, that the inwardness of the proffered but unsmoked hundred-dollar cigarette became known.

Wells, illegal connections, by-passes and the valves controlling illicit flow were all camouflaged in the attempt to escape the eye of the inspector. There is the classic example of the hook-up on one lease where the flow valve was concealed under the raised section of a certain indispensable outhouse—to which the wife of the switcher would invariably betake herself upon the approach of strangers or the known Commission inspectors.

Another ambitious hot oil producer completely sealed in his well with a concrete slab as heavy as any the Hindenburg line boasted during the World War, burying his flow line a good 20 ft. below the surface to dodge the shovels and doodle-bugs in the hands of probers. As with many whose ambition overreached them, the scheme backfired: paraffin clogged the upper part of the well tubing, while sand, washed in by the uncontrolled flow of oil through the screen, bridged and blocked off the bottom of the well. To rework the hole it was necessary to drill and blast off by fragments the heavily reinforced cover, exposing the scheme to view and the schemer to ridicule.

Still another concrete slab, upon which were mounted the engine and pumping rig for eventual use when the field went on the pump, covered its well and the valves through which it was illegally produced. The stub of tubing, Christmas tree and other fittings showing at the edge of the base were mere props, the bottom of the supposed casing a scant five feet below the surface of the ground. This man's scheme was exposed when a slender steel rod or probe, being used to sound the ground around the well, broke through into the tunnel concealing the buried flow line and valves.

Houses were erected and lived in over wells or by-passes, with trap-doors to give access to the necessary connections for illegally producing the crude. Although the inspector credited with the discovery is no longer in East Texas, there is a story still related in the field regarding one of these camouflage homes which is said to trace the original tip to the young hopeful of the producer's family who got into a hot argument with schoolmates regarding the features of their respective dwellings. "Huh," boasted the lad, to end the argument, "that ain't nothin'. Our house has got a by-pass in every room 'ceptin' the kitchen!"

At one time a number of wells bordering on the zone where natural flow had ceased were put on the pump, and the official allowables as promulgated by the Commission barely made after much pumping. This legal production was obtained through the usual tubing string, and all the while the same wells were flowing many times their rated allowable through the casing and running the hot oil so secured to the same refinery which, openly and above-board, was purchasing the allowable won through the unnecessary but misleading pumping.

Both Commission inspectors and investigators for private companies were sometimes victimized by the hot oil runners. One by-pass uncovered was especially barefaced in planning and execution, and the legitimate owner planned to follow prosecution through the courts until an example was made of the offenders.

Appearing on the scene with his camera, an incipient blaze in waste oil near the by-pass drew his attention for a few minutes and, when the excitement was over, he proceeded to snap every angle of the hook-up, manoeuvring to include in his views every one of the men accused of making the tie-in. Hopefully he sent away the films for development, and boasted to his lawyer that he had the crooks nailed to a board for the world to see.

When the developed films were returned to him, it appeared that he had not been quite as sharp as the hot oil thieves, after all. Every exposure was completely and thoroughly ruined—light-struck in every instance. Not a detail was recognizable in any view, but it was not until the leaseholder went to his camera supply house to protest that he had been sent someone else's films did he learn the truth: the bellows of his camera had been carefully yet thoroughly ventilated by being perforated in the corner folds with a pin. Since all previous pictures taken had been sharp and clear, it was plain that the damage must have been done at the site of the by-pass—and during the few minutes while the fire claimed all attention.

JAIL TERMS NEEDED FOR OFFENDERS

The only legal recourse open to the Railroad Commission—as an agent of the state of Texas—against violators of its orders is for the Attorney General to sue illegal operators for penalties. It was long before the courts could be educated to realize that a fine of from $10 to $25, while perhaps a serious punishment to a small farmer, was less than a slap on the wrist to an operator who might be running as high as 10,000 bbl. of oil per day and whose savings—even if the landowner was in on the deal and received any royalty at all—would pay the fine many times over during the first hour and leave the bulk as clear profit. The maximum fine allowed by law is $1,000 for each day's violation—still far below the limits of profitable running of a well wide open, if a prompt and sufficient market for the oil so produced is available.

Although it was not until the dual work of education and hot oil reduction was well under way that any attempt was made to classify the culprits as old offenders and neophytes, it is well known that some men were apprehended in flagrant violations as many as 25 times—only to resume their

Nobody claimed this well-built orphan by-pass, once it had been uncovered by the Railroad Commission inspectors; but, tied in to a high pressure main on one end and a refinery line on the other, it could easily solve the crude supply for somebody—and keep a lease switcher in cigarette money.

wilful disregard of Commission orders and the rights of their neighbors as soon as they could arrange to get back on the job after being forced to spend perhaps half a day in court.

Where, as may be checked from records in the Gregg County court house, some of the leases involved most persistently in illegal production changed hands frequently, reaching the owner was practically impossible, due to the law's delays. In one instance a producing lease underwent three (nominal) changes of ownership within one day, and was recorded as having passed through eleven owners' hands during the span of a single week. Legal recourse against leaseholders was so far behind the times that convictions, when secured, were practically outlawed by the many changes in proprietorship.

Because of this facility for passing the titular buck, the Commission early concentrated all efforts on throttling the outlets through which any illicitly produced oil must flow—obtaining such a close check on actual production that the present loss, in July of 1937, is placed at less than one fourth of one percent of the daily production from the field.

Such a tiny dribble—comparatively speaking—takes place through the occasional by-pass installed and operated over the short time elapsing before detection by the ever-vigilant inspectors. Just as there are still cases of automobile theft, despite the fact that laws prohibiting such an offense have long been on the statute books, and auto-thieves are universally regarded as law-breakers. This last condition is also now true in the oilfields regarding proration busters, thanks to the unremitting efforts of the Commission to educate landowners, producers and crude oil purchasers to the dollars-and-cents value of uniform, regulated production of crude.

As a result of this experiment in conservation education, the East Texas field to-day shows a very gradual bottom-hole or reservoir pressure decline, a big majority of the 23,000 wells are still flowing naturally and the number of those on the pump is being augmented but slowly.

Also, though conservation of the state's natural resources of oil and gas is based purely upon material considerations, the landowners and leaseholders in the area have already received in cash more than would in all probability have been their entire returns had the field been allowed to flow wide open and the vast volume of crude thus produced been dumped on a market unable to absorb it—with consequent price-cutting and staggering loss of semi-refined products through enforced earthen storage of topped crude after enough gasoline had been skimmed therefrom to cover the crude cost and yield a profit with a minimum outlay of labor and equipment.

Proration of the East Texas field stands as a monument to the unremitting efforts put forth by the Commission to secure:

Adequate legislation to legalize necessary Commission activities;

Adequate penalties to discourage perennial violators. (A third or fourth offender statute similar to the one now applying to criminals in New York state if enacted would quickly decimate the ranks of producers and operators who now must be constantly watched);

Thorough appreciation by landowners and leaseholders that their interests would be best served by orderly and restricted flow of crude from the sands below their lands;

Education of the public to the point where Commission activities are regarded as commendable participation in the management of the state and its resources, and thus an aid toward bearing or lightening the tax burden on the average individual.

That this program has been effective and successful may be proved by two simple comparisons. Before the Commission assumed its job in 1933 daily overage averaged 200,000 bbl.—now 1,500 bbl. per day will more than cover all crude produced in excess of proration limits. Where formerly there were 84 refineries within the area, there are now from 13 to 16 operating daily, and all but one of these are straight cracking units.

One-Third of
BRAZIL'S REFINED OIL IMPORTS
are from the United States

Nearly Two Decades of Oil Exploration Fail to Reveal Indigenous Petroleum Resources, but Search Continues—Small Domestic Refining Industry Developed.

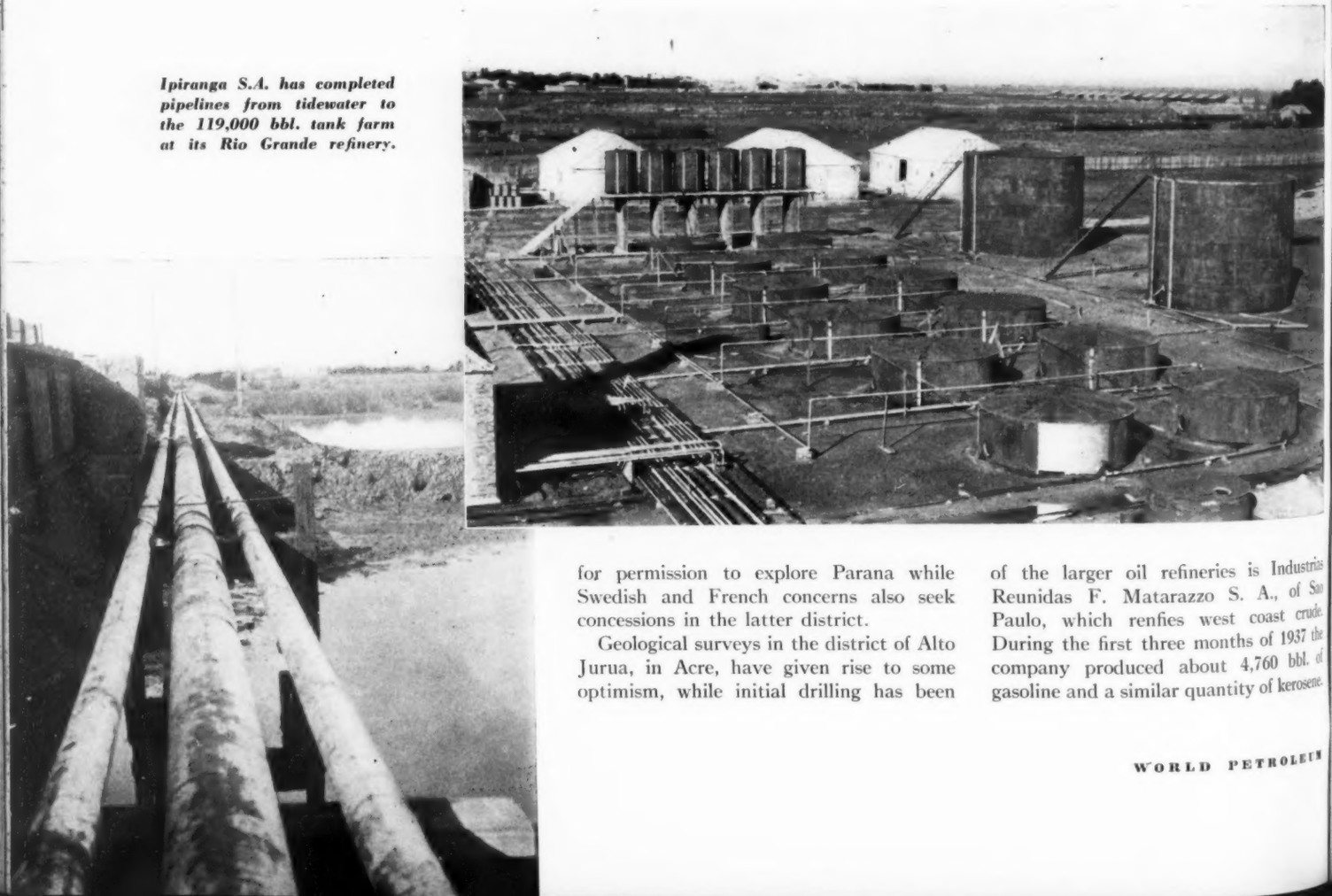
NO PETROLEUM is produced in Brazil, but for many years past the government has been spending considerable sums on search for crude oil within the country. In the past seventeen years some $3,600,000 have been expended in geophysical exploration and drilling in the southern states, the coastal belt and lower Amazon valley. The search has made itself felt mostly in the states of Matto Grosso, Para, Alagoas and in Acre territory. A preliminary geological survey was made in the swamp lands of Matto Grosso—an extension of Bolivian Chaco—while sounding is proceeding on the Monte Alegro tableland of Para.

Geophysical prospecting has covered approximately 750 sq. mi. of the sedimentary zone in Alagoas. Conclusions drawn upon the data obtained indicate a sedimentary thickness varying from about 2,100 ft. to more than 3,000 ft.; structures suitable for drilling have been located. One area presenting some possibility of oil deposits lies a few miles northeast of the Air France landing field. A more promising site has been determined at Ponta Verde, which is apparently the axis of a northeast southwest anticline, lying to the east of Maceio and Jaragua. Drilling equipment has already been installed. The locality offers prospects of finding the crystalline base at an approximate depth of 2,400 ft.

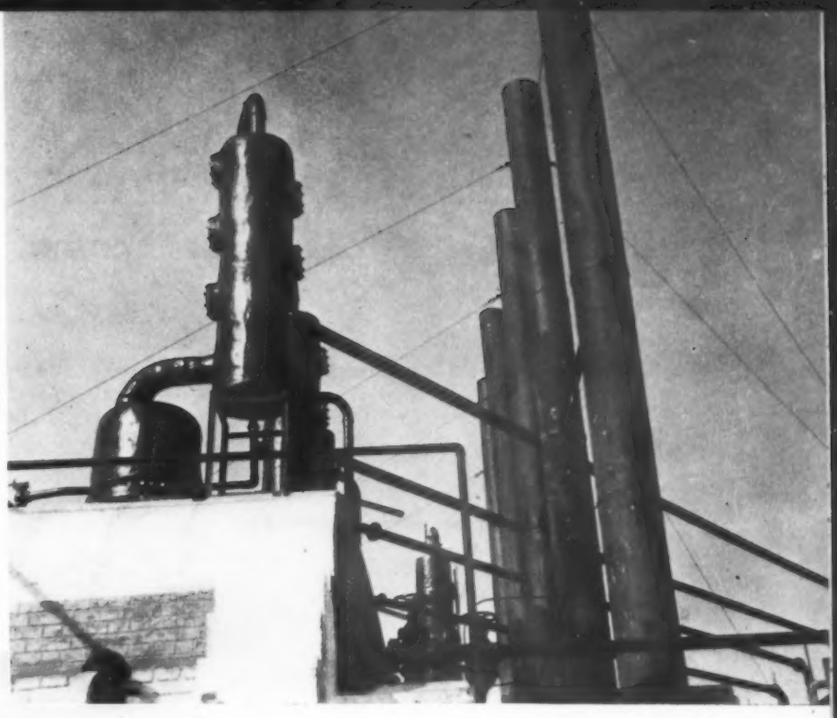
Reports state that a German firm, which has already prospected with some measure of success in Alagoas, has applied for permission to explore Parana while Swedish and French concerns also seek concessions in the latter district.

Geological surveys in the district of Alto Jurua, in Acre, have given rise to some optimism, while initial drilling has been commenced with two rigs, capable of reaching 4,500 ft., at Cruzeiro do Sul, in the Moa mountains six miles from Gibraltar.

A relatively small amount of crude oil is imported into Brazil—principally from the west coast fields of Argentina and Ecuador. There are no large refineries in the country; most of the plants are of a minor and somewhat primitive character and are primarily producers of kerosene. The principal refinery established in the country is Distillaria Rio Grandense de Petroleos Ltd., which is situated at Uraguayana, Rio Grande do Sul. It came on stream at the end of 1934, so no figures are available for that year's small output, but in 1935 the production was 5,007 bbl. of gasoline and 4,863 bbl. of kerosene, compared with 8,810 bbl. and 8,570 bbl., respectively, in 1936. Combined output of gasoline and kerosene, during the latter year, by all other Brazilian refineries amounted to 7,143 bbl. and 23,809 bbl., respectively. Distillaria Rio Grandense de Petroleos, Ltd., has a crude oil input of 84 bbl. per day. Another of the larger oil refineries is Industrias Reunidas F. Matarazzo S. A., of Sao Paulo, which renfies west coast crude. During the first three months of 1937 the company produced about 4,760 bbl. of gasoline and a similar quantity of kerosene.



Ipiranga S.A. has completed pipelines from tidewater to the 119,000 bbl. tank farm at its Rio Grande refinery.



Rio Grande refinery of Ipiranga S.A. as it nears completion. The plant has a daily capacity of 1,000 bbl. and has appreciably increased Brazil's small oil refining industry.

An important newcomer to the refining industry in Brazil is Ipirange S.A., Cia. Brasileira de Petroleos, which has completed its installation at Rio Grande, Rio Grande do Sul. Initially planned to come on stream during July, opening was later postponed for October, 1937. The company has a capital of 18,000 Contos ($1,080,000) and will bring crude from the west coast oilfields through Argentina. Tankage amounting to about 119,000 bbl. has been erected, and pipelines run from the docks to the refinery. Fifteen railroad tank cars are being imported for use on the Viacao Ferrea do Rio Grande do Sul Railway. The installation includes a pump house, warehouse and laboratory. Ypiranga

S. A. contemplates an initial throughput of about 1,000 bbl. daily, to be increased later on to some 1,200 bbl. While it is understood that the refinery's concession does not exempt it from the payment of state taxes, it is reported to be the intention of the company to enter a good portion of its products in the name of Distillaria Rio Grandense de Petroleos Ltd., at Uruguayana, whose concession does provide for exemption from such taxes.

No change has been made in existing Brazilian tariff differentials between crude oil and refined products, and none is known to be actively contemplated. It is the opinion in the trade, however, that any substantial increase in refining activities and concurrent reduction of government revenues from loss of proportionate import duties, will cause either increased duties or a levy of special taxes on refineries.

Gasoline consumption of Rio Grande do Sul, slightly more than 600,000 gal. per month, is at present supplied largely by four non-domestic companies. If the Ipiranga refinery is successful, it would appear that it will have an important effect on companies doing business in that state.

Brazil's Federal Sugar and Alcohol Institute has been actively supporting the admixture of motor alcohol with gasoline, as part of a scheme to aid the distressed cane sugar industry. To some extent the development of gasoline sales has been hindered by this policy of the government. Surplus stocks of alcohol manufactured from molasses and sugar have been forced on distributors, although supply is irregular due to lack of dehydration plants.

Gasoline consumption in Brazil has been largely confined to coastal regions due to the difficulties of developing long-distance motor transport in a country with such physical characteristics. There were approximately 600 filling stations and 6,500 gasoline pumps in the country at the beginning of 1937, of which some 100 were operated by the four major non-national companies. The latter stations averaged 84,000 gal. sales each during 1936, compared with 50,000 gal. by the former.

Consumption of kerosene has recovered to its pre-economic depression level, while the demand for lubricants is still below—possibly to no small extent due to increased economies effected by improved engine design and higher quality lubricating oils. Demand for heavy oils is striking; this is partly due to the highly profitable bunkering business that has been developed at ports along Brazil's vast coastline, and is also a reflection of industrial progress.

The United States is undoubtedly the largest individual seller of refined petroleum products to Brazil, and supplied some 30 percent of her 1936 demands. During 1936 about 43 percent of the gasoline imported was from America, compared with 28 percent from Netherlands West Indies and 22 percent from Peru. About 99 percent of the aviation gasoline brought into the country was from U.S.A., the balance coming from Great Britain. United States also took first place in kerosene imports, at 72 percent, while Peru and Mexico almost tied for second place at 12.8 and 12.7 percent, respectively. Netherlands West Indies held the honors as greatest shipper of fuel oil to Brazil in 1936, with a total of 90 percent, while Mexico was second with 6.9 percent. America shipped 88 percent of the lubricating oil imported, while Mexico consigned 7 percent and Great Britain 4 percent. Other imports from U.S.A. were: transformer oil, 86; unspecified mineral oils, 85; paraffin wax, 98; lubricating grease, 96; and asphalt 60 percent.

Consumption of Petroleum Products 1933 to 1936

(Barrels)

	1936	1935	1934	1933
Gasoline	2,745,500	2,422,500	2,201,500	1,853,000
Kerosene	790,500	651,000	744,000	612,250
Lubricating oil	217,500	246,500	224,750	203,000
Diesel oil	543,750	507,500	471,250	478,500
Fuel oil	3,500,000	3,059,000	2,772,000	2,450,000

Imports of Petroleum

	First Half 1937	Total 1936
	(Barrels)	
Crude oil	71,119	93,123
Gasoline	887,353	2,765,917
Aviation mixture	Nil	853
Kerosene	421,119	678,458
Lubricating oil	140,518	227,525
Transformer oil	5,105	8,320
Fuel oil	1,176,637	2,328,795

CUBAN EXPLORATION
Retarded by Archaic Laws

New Oil Law and National Petroleum Company Proposed in Endeavor to Create Producing Industry Now Stalemated by Inadequate Mining Regulations—Present Output and Dearth of Geological Information.

LITTLE-KNOWN because of its almost negligible volume, Cuba's oil producing industry is handicapped by the country's obsolete mining laws. The situation is one that may be solved, as has been the case in other lands, by passage of suitable legislation aimed to encourage the interest of major oil concerns in the country's possibilities. The June 31st, 1937, issue of NOTICIERO MERCANTIL, of Havana, contained an editorial attacking the root of the evil, and stated—"Prospective companies do not undertake the exploitation of Cuban (oil) deposits because they encounter obstacles in certain archaic and self-defeating legal requirements. The subsoil of Cuba is almost entirely in the hands of those that do not know how or cannot exploit it. Those that would know and could, do not do it either, because they are prevented by those just mentioned. There exists here a legal knot that it will be necessary to untie before permitting the development of this new wealth, and this country needs the untying of that knot. Otherwise, the question of our petroleum will continue to be a mysterious taboo."

Such goading by the local press from within, together with pressure from trade interests from without, have had their results. Still in embryo, the Cuban oil industry has at last attracted the attention of the legislative authorities. Existing mining laws anti-date by a hundred years the discovery of petroleum, and under them mining concessions were granted without time limit—with the result that most of the country has been plastered with *denuncias*, which even the present owners have forgotten. To clear away these encumbrances the Cuban House of Representatives has under consideration at time of writing a project of law that will either bring to life or invalidate these old concessions, and open the way for new enterprises. If enacted the law would make it possible for responsible concerns to prospect for oil on private or public lands and will see to it, when oil is found in commercial quantities, that the public treasury will duly benefit.

According to its present provisions, the National Petroleum Law would consider all petroleum deposits in the republic as government property, concessions granted by the government being classified as public utility enterprises. Only Cuban citizens or organizations would be granted such concessions which would be valid for two years of exploration. Non-nationals would be required to operate through Cuban subsidiaries. Development concessions would be valid for 30 years, renewable for a period of not more than 15 years, while all equipment and supplies necessary for exploration and development would be admitted duty free.

Not the least interesting of the clauses of the new law is that which would provide that concessions cancelled for non-payment of royalties, failure to develop, etc., shall be transferred to the "national petroleum reserves." A fifth of all areas under concession would also be retained by the government as national petroleum reserves—this item being retroactive to include concessions granted under the old regulations. At the request of the National Petroleum Company of Cuba, any lands not covered by concessions would be considered as "original petroleum reserves", provided such original reserves do not exceed 300,000 hectares. Included in such reserves would also be concessions that are relinquished or expire at the end of the 30- or 45-year period.

The National Petroleum Company of Cuba would engage in the exploration and development of petroleum deposits in Cuba, expecially the rational petroleum reserves, and it may engage in the petroleum refining industry. It would have an authorized capital of 10,000 shares of common stock of no par value and 15,000,000 shares of preferred stock of $10 par value. For concessions and benefits granted to the company the Cuban government would receive 9,200 shares of common stock, on which stock at least one-third of all dividends declared by the company must be paid. A commission composed of the chiefs of government departments and delegates of professional and economic organizations would draft the by-laws of the National Petroleum Company of Cuba, which would be exempt from all taxes.

EXISTING OIL AND ASPHALT DEPOSITS

Proof of the existence of a petroleum industry in Cuba is contained in figures lately published by the Cuban Bureau of Forests, Mines and Waters. Statistics of asphalt production go back to 1909, when the total output of this mineral was 19,476 tons. Oil was first recorded in 1916. The figures for both products since that date are given in the accompanying table.

The Cuban petroleum industry is still small, but the area of possible production is extensive. Indications exist in the provinces of Santa Clara, Camaguey, Pinar del Rio and Matanzas. Crude oil and gas are being produced by Union Oil Company (no connection with the Californian concern of that name) in the Bacuranao field, located a little less than 60 miles east of Havana.

CUBAN OIL AND ASPHALT OUTPUT

	Asphalt*		Petroleum
Year	Production Tons	Exports Tons	Production Bbl.
1916	489	489	113
1917	473	473	20,386
1918	450	450	20,796
1919	640	640	9,226
1920	3,044	3,044	10,277
1921	343	343	5,345
1922	109	109	4,063
1923	2,098	2,098	3,307
1924	3,643	3,643	3,877
1925	2,814	1,534	3,501
1926	7,988	24,173	1,977
1927	4,116	25,046	2,559
1928	13,185	11,133	1,260
1929	15,616	5,304	1,933
1930	20,698	9,282	7,006
1931	9,689	13,644	8,759
1932	5,302	7,457	17,452
1933	4,975	7,587	8,890
1934	3,634	7,378	6,157
1935	3,782	5,029	6,067

*The figures apparently show an excess of exports over production probably because exporters of asphalt have not reported all their production.

There are 58 wells in the field, of which 12 are producing an asphaltic oil with an average gravity of 29 deg. Beaume. This is locally refined into kerosene, gas oil and other products. Nothing of a definite nature has been published regarding geological conditions in the Bacuranao field.

The field's total output of refined products during 1936 is given as 10,714 bbl. Quite recently the Union Oil Company commenced distributing compressed natural gas for domestic and laboratory use in

Havana, Guanabacoa and Marianao and sales are reported to average 200,000 cubic meters monthly.

Little is known about the Motembo field, in northwestern Santa Clara province, where the San Juan and San Elias "naphtha mines" have been operated for a long time. The raw product is a natural naphtha distillate which is locally sold in direct competition with gasoline at 21 cents per gallon.

Much interest has been aroused by the opening of the Vesubio naphtha mine, three-and-a-half miles southeast of the San Juan mine. This extension of the field has resulted in considerable drilling activity and several companies, chief among which is Motembo Mining Company, have drilled some 40 wells to depths ranging from 900 to 1,200 ft. Of these wells nearly a third have found naphtha.

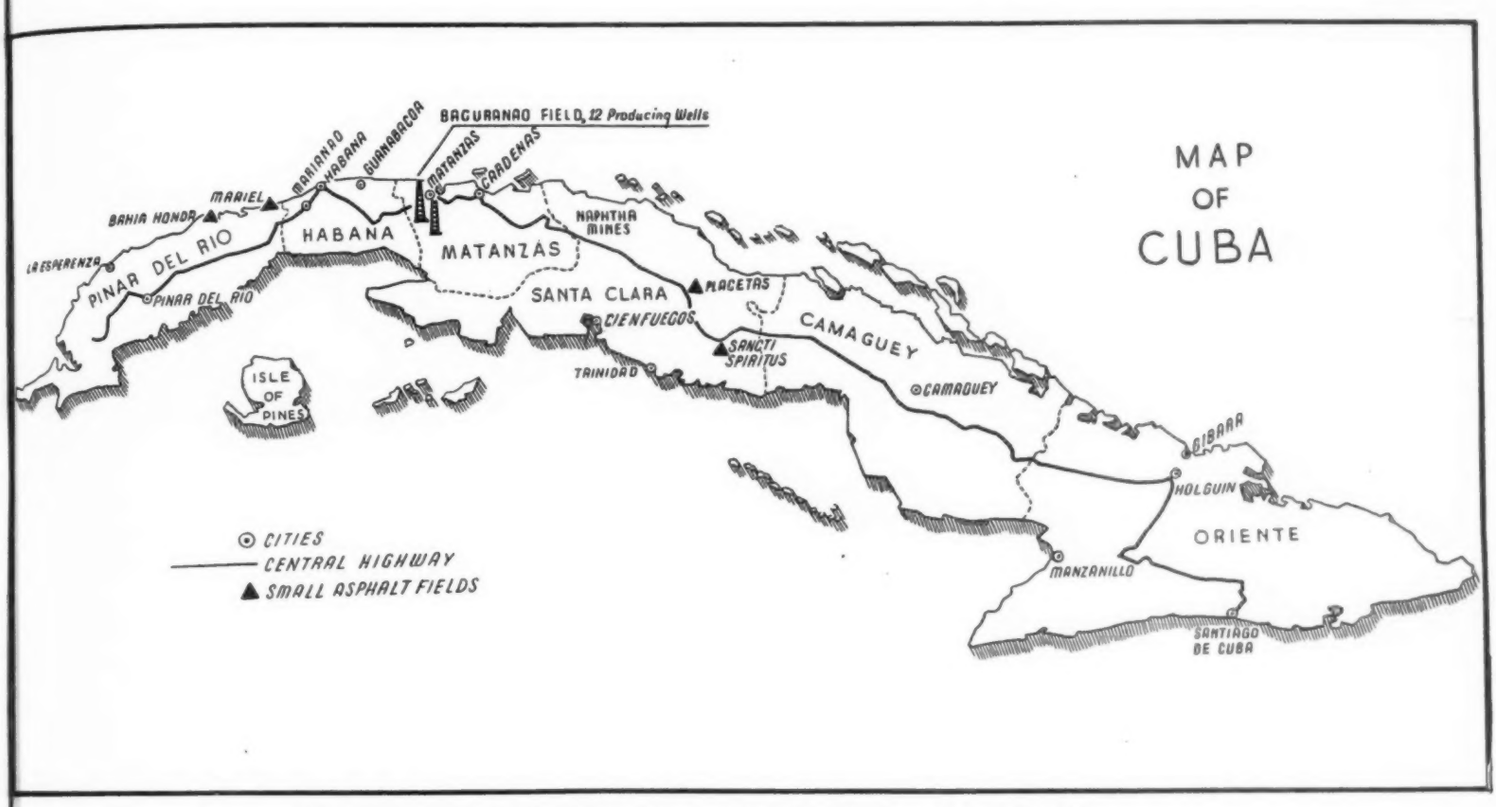
No authoritative geological information or other technical details are available with regard to Motembo—government officials have been unable to obtain precise data even as to production. The field has been producing since 1921. The annual report of Motembo Mining Company for 1934 specifies an output of 2,584 bbl. for the year, while information from local sources indicates an average daily production of 149 bbl. in 1936, or about 53,500 bbl. for the year.

Aside from Bacuranao and Motembo there are several small fields that produce natural asphalt. Among these is the Brown Mine, in Mariel, Pinar del Rio, where during the period 1929-35 Compania de Asfalto de Cuba extracted a total of 15,674 tons, of which 6,577 tons were exported. Compania Nacional de Asfalto has two mines at Bahia Honda, Santa Elena and Santa Julia, from which it has raised 3,420 tons and exported 3,121 tons. Compania Minera "La Esperanza" and other small concerns operate a group of asphalt pits in Placetas and Sancti Spiritus, Santa Clara province. Production of this latter group in the stated period amounted to about 34,000 tons. Other small-scale asphalt enterprises are in the provinces of Matanzas and Camaguey, having a combined output estimated at nearly 10,000 tons for the seven-year period.

Geologically, the asphalt occurs in limestone horizons of the Middle Cretaceous. Shafts sunk in Santa Clara province have penetrated five workable strata of asphalt, varying from one to eight feet in thickness, while certain horizons of the Penton formation (Middle Cretaceous) show exudations of a thick oil. This hilly limestone region is extensively folded and faulted, which seems to give little hope of finding appreciable oil deposits. What the adjacent and flatter regions may contain remains for the future to disclose.

Pending enactment of the new law, a certain amount of tentative exploration is going on. Compania Petrolera "Carco" has obtained extensive concessions along the north coasts of Santa Clara and Matanzas and is making geological and torsion balance studies in the region—seismographic investigations are not applicable because of the slight difference between velocities of seismic waves in the limestone strata and the underlying rocks. Aerial mapping is also being conducted.

Two large international concerns are now engaged in exploration of Cuba. They are Compania Petrolera La Estrella de Cuba, subsidiary of Royal Dutch-Shell, and Atlantic Refining Company of Cuba, offshoot of the Philadelphia concern. As yet no drilling has been done. Their work includes geological and geophysical studies, but such information as they have gathered has been kept confidential.



Cuba already has one small oilfield with some 12 wells producing a few barrels daily, several small asphalt deposits in various parts of the country and three naphtha mines are also being exploited.

NEW REGULATIONS Permit Further Exploration in Egypt

Government Is Anxious for Outside Enterprise to Develop Her Oil Resources Yet Desires to Oust Non-Domestic Firms from Local Market.

ANGLO EGYPTIAN Oilfields Ltd. (Royal Dutch-Shell), holding concessions at Hurghada, on the Red Sea littoral, is the principal petroleum producer in Egypt. The concern's Gemsah field was exhausted in 1927. An insignificant amount is also extracted from the Abu Durba field, on the Sinai Peninsula coast, which is operated by Zaki Bey Wissa (Egyptian Oil Syndicate). The slight increase recorded in the 1936 output is attributed to deepening of some of the older wells at Hurghada. The result obtained was not regarded as profitable, and production is again declining.

In view of the decline of Hurghada yield Anglo-Egyptian has long been anxious to obtain further prospecting rights, but negotiations for further permits were postponed pending promulgation of new legislation. New mining regulations were drawn up in January, 1937. These are divided into three sections: (1) petroleum exploration permit and regulations for the registration of same, (2) petroleum prospecting license, and (3) petroleum mining lease.

Despite certain restrictive points, terms of the new legislation appear to be far more reasonable than the previous law—reflecting the government's desire to stimulate development of further domestic supplies.

Among the important points is the requirement that lessees shall employ 90 percent native labor and that administrative and technical staff shall include at least 50 percent of Egyptian nationals. As well as the features having a revenue-producing objective, political reservations which were inspired by Egypt's new national status are made under the section covering grant of mining leases.

As the revised legislation is an improvement on the old and corresponds more closely with those in other oil producing countries, some of the leading petroleum companies have applied for exploration permits. Anglo-Egyptian was the first to apply for the maximum of 40 areas, covering 2,400 sq. mi., and similar applications have been made by Jersey Standard's subsidiary Standard Oil Company of Egypt S.A. Socony-Vacuum has also applied for 31 areas and is expected to later apply for the remaining nine, while Zaki Bey Wissa has applied for two additional exploration permits of 60 sq. mi. each, near Abu Durba.

Interest of other prospecting concerns was aroused by the activity in Egypt, and it is reported that D'Arcy Exploration Company Ltd. (Anglo-Iranian) has approached the Egyptian government to obtain exploration permits for the maximum number of licenses. The areas which the company desires are situated in the western part of the Delta, south of Alexandria. As the government has refused to consider applications for exploration permits in areas bounded between the Suez Canal Company's concession and the Nile Valley (because of the military reservations made under the Anglo-Egyptian Treaty) it is a question whether the application made by D'Arcy may be refused because of the strategic location of the areas involved.

There are two refineries operated in Egypt; one by Anglo-Egyptian and the other by the government. Both are at Suez. While output of the oil company's plant has remained fairly constant, the government refinery continues to increase its output steadily. Daily capacity of the former is about 8,400 bbl. and that of the latter 1,200 bbl. Domestic petroleum is blended with imported crudes in order to increase local production of light fuels and asphalt.

The government plant has been enlarged and modernized and can meet a substantial part of the requirements of its various departments. Tendency toward increasing government output is motivated not only by nationalistic views but also by the vast program of public works. Although primarily designed to aid Egyptain defense measures, the opening of new roads and modernization of existing highways will be of potential value to the country's normal life and will broaden the demand for petroleum products.

Egypt is covering her needs of petroleum products to a constantly increasing extent from Asiatic countries rather than European and American sources. This is natural because of distance and higher cost of haulage. Bahrein has made substantial gains in the Egyptian crude oil market in addition to the black products field.

Shrinkage in Egypt export business in asphalt and its derivitives and in fuel oils is attributed to unsettled economic and political conditions in markets such as Palestine, Syria and Iraq in addition to lack of orders from Italy's African possessions.

Except for a slight recession in consumption of fuel oils used in industrial and agricultural activities, there has been a rapid increase in consumption of petroleum products in Egypt in the past few years—although electric power is making substantial progress. Kerosene remains the best seller and is used to an increasing extent both in cities and the interior of the country for domestic purposes, since the cost of electricity is relatively high.

Distribution of petroleum products in Egypt is almost entirely in the hands of Shell Oil Company of Egypt Ltd., Socony Vacuum Oil Company Inc. and Societe du Naphte A.I. Mantacheff S. A., which control more than 80 percent of the market —concerns composed largely of Egyptian nationals cover the remainder.

Recent developments in the marketing side include the formation of two Egyptian oil corporations, both at Alexandria. Societe California-Texas des Petroles (California-Texas Oil Company) has commenced operations in connection with marketing fuel oil bunkers at Suez and Alexandria. The concern contemplates entering the open market in the future, expanding its activities to distribution of other products. Should such a project be carried out arrangements would be concluded with existing firms to regulate its operations especially as to uniformity of prices.

Formation of Nile Oil Company is the outcome of an old scheme promoted by a few prominent Egyptians and revived with the aid of Creditul Minier and of others associated with Roumanian oil concerns.

The activities of the Co-operative Centrale des Petroles, though at present limited, will probably expand due to the government's readiness to assist this institution and its affiliates. Practically every important urban center throughout the country has its co-operative society, which is sponsored by the government and financially assisted directly or through the Credit Agricole, a semi-government institution. These organizations have lately taken up marketing of gasoline, particularly since formation of the Co-operative Centrale. Although these societies

were designed to supply only members, in order to augment the compensation of their agents, who are poorly paid, they are entering the open market.

Government favoratism is evidenced by the instruction to various departments to give preference to tenders by the Co-operative Centrale even if prices are 10 percent higher than those of other bidders.

The spirit of nationalism has been intensified by the new political status of the country following the Anglo-Egyptian treaty and there is no question that the government is favorable to Egyptian concerns supplanting the non-domestic oil distributing companies who occupy dominant position in the market. An illustration of this trend is the assistance given by the government to the co-operative societies. General criticism in Egypt is that the major oil companies are profiteering at the public expense, and this is supported by the national press. The question of the non-domestic petroleum companies has also been raised in parliament where they were bitterly attacked, but charges made against the companies are far from being borne out by an impartial consideration of the facts.

The principal oil companies are watching these movements with concern, as the activities enroach upon their distribution fields both in the open market and government supplies.

It is problematical as to the success of the newly formed national organizations as despite the support of the government this advantage is offset by the experience and organization of the present long-established oil distributing concerns.

EGYPTIAN STATISTICS

Area: 596,400 sq. mi. Population (1937): 15,904,525. Inhabitants per sq. mi.: 26.7.

Principal industries: cotton, sugar, tobacco, oil cakes, hides, wool, textiles, pottery, glass, phosphate, ivory, petroleum, sponge fishing, cement, wheat and fruit.

Railroads: length, 1,784 mi. standard gauge, 2,632 mi. narrow gauge, 4,416 mi. total. Passenger carriages, 1,031; passenger traffic, 32,200,000; passenger miles, 730,-200,000. Locomotives: 683. Freight cars, 15,283; freight traffic, 4,770,000 tons; freight ton-mi., 613,800,000.

Highway systems: 4,046 mi.; automobiles to mi. of road, 7.1.

Motor vehicles: passenger cars, 25,568; buses, 1,164; trucks, 3,589; total registrations, 30,321; population per vehicle, 509. Motor cycles: 3,300.

Merchant marine: 44 steamships, aggregating 40,505 net registered tons; 173 sailing vessels of 11,662 tons.

Navigable length of canals: 1,018 mi. Total length of canals, 12,089 mi.

Retail oil prices and taxation (U.S. cents per gallon)—Aviation gasoline (inclusive of 4.4 cents duty and 13.1 cents tax): 59.7 cents at Cairo in tins, 57.2 cents at Alexandria in tins and 52.9 cents in bulk. Ordinary gasoline (inclusive of 4.4 cents duty and 13.1 cents tax): at Cairo in tins, 40.0 cents, in bulk, 35.1 cents; at Alexandira in tins, 37.7 cents, in bulk, 33.1 cents; at Port Said in tins, 37.8 cents, in bulk, 36.2 cents. Kerosene (inclusive of 1.1 cents duty and 1.0 cent tax): at Cairo in tins, 15.3 cents, in bulk, 11.1 cents; at Alexandria in tins, 13.7 cents, in bulk, 9.5 cents; at Port Said in tins, 22.6 cents, in bulk, 19.4 cents. Lubricating oils (inclusive of 4.4 cents duty and 3.6 cents tax): No. I at Cairo 132.0 cents and at Alexandria 134.4 cents; No. II, at Cairo 91.2 cents and at Alexandria 113.6 cents; No. III, at Cairo 71.2 cents and at Alexandria 105.6 cents.

Crude Oil Production

Year	Barrels
1932	1,854,057
1933	1,627,895
1934	1,501,624
1935	1,234,170
1936	1,241,350
1937*	1,154,000

*Preliminary estimate

Egyptian Oil Imports

	1936 (Barrels)	1935	Increase or Decrease (Percent)
Crude oil	905,653	657,293	+37.8
Gasoline	246,381	165,376	+48.5
Kerosene	2,139,105	1,940,625	+10.2
Fuel oil	1,784,674	1,991,445	—10.8
Lubricating oil	112,331	175,269	—35.9
	(Tons)		
Asphalt, etc	7,438	6,189	+20.5

Production of Refined Products

Products	1936	1935	1934 (Barrels)	1933	1932
Gasoline	763,583	634,670	825,218	727,926	761,141
Kerosene	202,747	193,673	200,640	120,990	148,582
Gas oil	123,531	82,923	144,273	83,224	94,874
Fuel oil	838,397	896,296	673,967	894,005	1,143,448
Diesel oil	84,245	92,474	118,051	118,411	40,288
Other oils	5,355	4,669	3,465	3,003	1,491
			(Tons)		
Asphalt	85,762	92,464	58,562	48,640	58,188

Consumption of Refined Products

Products	1936	1935	1934 (Barrels)	1933	1932
Gasoline	703,060	648,584	539,826	468,852	519,401
Kerosene	2,272,267	2,431,737	2,206,597	2,135,768	2,193,303
Gas oil	168,616	159,679	133,910	105,517	93,220
Fuel oil	378,088	487,274	348,130	493,189	497,974
Diesel oil	1,108,235	1,135,251	989,458	886,595	832,945
			(Tons)		
Asphalt	33,237	20,824	16,914	13,556	12,340

CHINESE INCIDENT Leads to Rationalization of Oil Consumption in Tokyo

By Morio Otaki

COMPLEMENTING the government drive for increased production of petroleum from domestic sources which has been receiving greater impetus under the emergency situation resultant from the outbreak of the China Incident, the rationalization of gasoline consumption is being urged in Japan. The new movement is directed principally toward economizing fuel consumption by automobiles, a phase of demand which accounts for more than 95 percent of the domestic gasoline consumption. According to government statistics, gasoline consumption in Japan during 1936 was divided into automobile consumption of 7,952,986 bbl. representing 95.9 percent of total consumption, aircraft consumption of 114,046 bbl. or 1.4 percent of the total and all other uses accounting for 227,174 bbl. or 2.7 percent of total consumption.

The more recent survey by the newly-created Imperial Bureau of Fuel has shown the greater dominance of automobiles in domestic gasoline consumption in the first half of 1937, as 96.6 percent of total consumption was devoted to this use. During this period aircraft consumed 0.7 percent of the total, rubber industry, 2.2. percent, paint industry, 0.4 percent, and soya bean oil extraction, 0.1 percent.

In the present drive toward the economization of automobile fuel, closest attention is apparently being paid to the waste of gasoline consumed by cruising taxis. It should be noted that the development of automobile transportation in Japan has not kept pace with the increase in the number of taxicabs. With the number of privately-owned cars being extremely small in this country in comparison with other civilized nations, the mileage being run by vacant taxis cruising in streets in search for passengers is incomparably larger than in American and European countries. Naturally, the gasoline consumption by cruising taxis amounts to a big volume. The situation serves to increase per-car consumption of gasoline in Japan to from three to five times as much as in other countries. A recent survey places the per-car consumption of gasoline in Japan at 2,245 gal. annually. This compares with an annual per car consumption of 754 gal. in England, 529 gal. in Germany, 484 gal. in France and 483 gal. in Italy.

An investigation conducted jointly by the Section of Statistics of the Tokyo Municipality, the Tokyo Automobile Association and the Traffiic Bureau of the Metropolitan Police Board some time ago revealed that empty taxis in Tokyo cruise a daily average of 80 miles. Estimating that one gallon of gasoline lasts for 16 miles, and that there are about 16,000 taxis in Tokyo, it may be taken that cruising taxis waste some 80,000 gal. of gasoline a day in the City of Tokyo alone. The Japanese authorities in charge apparently believe it imperatively urgent and necessary to increase the number of taxi-parking places in the Empire in order to prevent the cruising of taxis without passengers and to check the waste of gasoline. If some 40,000 of the total number of taxis in Japan proper were enabled to reduce daily cruising mileage by an average of 16 miles as a result of increased parking stations, a saving of about 40,000 gal. of gasoline a day would be possible. This would amount to an annual total saving of 14,600,000 gal., corresponding to about five percent of the total gasoline consumption by automobiles in Japan proper. Exhaustive studies are being made by the government experts in this connection. Improvement of automobile engines and the employment of economic cars are also under consideration by the Japanese authorities as the two major measures for nationalization of gasoline consumption acutely necessitated by the prevailing situation. Cars used for taxicabs in Japan are largely monopolized by the two popular American brands, Ford and Chevrolet. Because of the perfection of automobile roads in the United States and the desire of the American public for higher speed, the American makers place special emphasis upon speed and horse power in the construction and design of those cars at a sacrifice of economical utilization of fuel. They are so designed that they prove most efficient at speeds as high as 4,000 revolutions per minute. In Japan, conditions are different. Because of the narrower width of streets and the resultant congestion of traffic, the hourly speed of automobiles is restricted to from 20 miles to 35 miles. Consequently, the American-made high-speed engines are always being operated at less than maximum efficiency. Because of many obstacles in the streets, buses are scarcely able to run at speeds greater than 10 miles an hour. Taking into consideration frequent stops at tramway stopping places and crossings, the automobile engines are mostly run at as low as 400-1000 r.p.m. In view of the economic value of automobiles, American cars are not regarded by the expert here as entirely suitable to native conditions in Japan at least so far as fuel economy is concerned. Japanese officials deem it important for the country to use the kind of low cost cars which suit local conditions in the Empire and have a smaller consumption of gasoline. It seems likely that Japanese authorities may take some concrete measures to control makes of automobiles to be used in the Empire so that the economization of fuel through this channel may be properly administered.

Tanker COMPEADOR going up in flames after being torpedoed by an unidentified warship in the Mediterranean while carrying a cargo of gasoline to Valencia. The COMPEADOR was a Spanish Government-owned vessel.

© Pictures, Inc.

WORLD OIL PRODUCTION—Official Figures

All figures furnished direct to WORLD PETROLEUM by governments, except where otherwise specified—Table revised monthly

(Figures in U.S. barrels of 42 gal.—Conversion ratios used are weighted averages for individual countries)

Country	October 1936	November 1936	December 1936	January 1937	February 1937	March 1937	April 1937	May 1937	June 1937	July 1937	August 1937	Preliminary Figures September 1937
United States	95,795,000	91,018,000	97,652,000	98,567,000	93,173,000	106,724,000	104,979,000	110,911,800	105,812,000	110,721,000	115,090,000	109,980,000
Russia[2]	16,786,683	16,683,894	17,413,623	16,117,461	13,796,325	15,907,051	16,401,771	18,130,230	17,953,812	18,580,752	15,830,000[1]	16,663,000
Venezuela	13,426,005	13,831,410	8,171,274	9,559,158	13,130,903	15,066,287	14,686,657	14,498,968	16,260,492	16,459,071	17,851,784	17,640,872
Roumania	5,224,000	4,982,000	5,050,000	4,768,000	4,217,000	4,595,000	4,412,000	4,494,000	4,151,000	4,317,000	4,293,000	4,256,000
Iran[3]	5,076,288	4,985,640	5,355,786	5,665,500	4,766,574	6,330,252	6,224,496	6,247,158	6,639,966	7,093,206	7,191,408	6,800,000
Netherland India	4,294,293	4,379,480	4,433,034	4,267,148	4,011,266	4,405,436	4,348,185	4,555,298	4,454,725	5,208,450	4,888,298	4,586,630
Mexico	3,235,224	3,204,007	4,259,733	4,233,635	3,922,929	4,307,952	4,249,838	3,387,950	3,338,311	3,848,587	2,800,858	3,432,000
Iraq[4]	2,234,805	2,359,875	2,161,140	2,638,745	2,386,687	2,709,260	2,665,259	2,747,102	2,344,213	2,429,587	2,429,787	2,513,145
Colombia	1,600,288	1,537,683	1,641,636	1,668,490	1,617,441	1,622,226	1,660,469	1,678,580	1,724,173	1,681,799	1,592,592	1,617,433
Peru[5]	1,521,894	1,459,534	1,506,716	1,462,871	1,335,130	1,479,964	1,426,891	1,451,220	1,427,939	1,484,382	1,835,800	1,600,000
Argentina	1,306,784	1,356,396	1,356,396	1,355,029	1,237,459	1,317,000[1]	1,267,000[1]	1,270,000[1]	1,278,000[1]	1,280,000[1]	1,296,000[1]	1,270,000
Trinidad	1,179,611	1,154,093	1,231,365	1,263,456	1,157,408	1,287,097	1,301,260	1,351,198	928,752	1,377,547	1,433,474	1,358,600
Burma	*	*	*	*	*	*	625,937	690,501	638,874	675,000[1]	650,000[1]	640,000
Bahrein[6]	209,086	419,643	619,910	730,064	549,260	799,994	659,557	432,748	684,348	694,000[1]	703,000[1]	700,000
Poland	325,940	318,360	325,940	300,886	295,620	316,844	318,360	318,360	310,780	318,360	293,000[1]	315,000
Brunei[7]	320,368	320,902	351,025	386,181	356,897	389,612	363,226	376,191	349,500	353,313	373,760	365,000
Germany	274,901	253,558	277,269	263,369	231,466	243,012	247,060	245,088	249,434	267,847	279,727	282,155
Japan[8]	200,528	202,385	212,326	219,410	194,037	207,423	198,898	206,544	200,092	204,710	214,819	206,000
Ecuador	168,892	163,870	175,918	180,058	160,675	180,727	181,352	189,658	182,711	186,175	184,780	178,122
British India	*	*	*	*	*	*	162,699	172,458	181,436	190,000[1]	201,000[1]	210,000
Sarawak[9]	138,717	133,913	139,708	136,658	124,609	136,887	130,481	134,523	131,625	143,445	138,031	134,311
Canada[10]	137,004	129,152	139,701	141,078	153,906	175,575	188,014	192,845	209,181	241,737	288,934	298,753
Egypt[11]	102,041	97,685	98,602	99,518	86,780	93,432	89,480	97,077	98,021	99,182	97,818	100,699
France	43,560	39,715	41,755	37,148	39,990	43,053	41,861	42,096	43,443	42,125	43,367	44,000
Czechoslovakia	9,591	9,767	9,632	9,311	9,595	9,383	9,574	8,824	10,824	11,529	10,000[1]	11,000
Other countries[1]	38,000	32,000	28,000	28,000	30,000	30,000	34,000	35,000	33,000	30,000	28,000	31,000
Total	154,380,363	149,851,579	153,461,707	154,856,110	147,741,816	169,180,794	166,873,325	173,864,417	169,648,654	177,948,814	180,049,247	175,233,720

[1]Estimate. [2]Russian Sakhalin included with Russia. [3]Anglo-Iranian Oil Company Ltd. figures revised; fuel oil returned to ground has been deducted. [4]Iraq Petroleum Company Ltd. export figures. [5]International Petroleum Company and Lobitos Oilfields Ltd. figures combined. [6]Bahrein Petroleum Company Ltd. figures. [7]British Malayan Petroleum Company Ltd. figures. [8]Japanese Sakhalin, Taiwan (Formosa) and Hokkaido included with Japan. [9]Sarawak Oilfields Ltd. figures. [10]Includes natural gasoline production. [11]Anglo-Egyptian Oilfields Ltd. figures.

*Burma and British India officially listed together prior to April 1st, 1937—aggregate ouput: 1936, October 730,860 bbl., November 778,617 bbl., December 809,218 bbl., 1937, January 757,936 bbl., February 756,859., bbl., March 803,327 bbl.

ALL crude oil production figures published on this page for the 1932 to 1937 period have now been checked and revised by the official sources.

In the past, attention has been drawn to the confusion caused by statistics which have been converted by means of a general factor, (such as seven barrels as the equivalent of one ton of oil) without regard to specific gravity. This has been fully realized and deprecated by WORLD PETROLEUM—commencing with this issue, all statistics on this page which are not received in barrels have been retrogressively converted with factors based on weighted average specific gravity for each country.

Official Crude Oil Production Figures for 1932 to 1937

	Daily Average to Sept. 30 1937	Daily Average 1936	Total to Sept. 30 1937	Total 1936	Total 1935	Total 1934	Total 1933	Total 1932
United States	3,501,776	3,001,410	955,957,800	1,098,516,000	996,596,000	908,055,000	905,656,000	785,159,000
Russia	547,181	545,453	149,380,402	199,635,921	184,008,033	175,635,783	155,596,429	155,927,997
Venezuela	495,107	424,237	135,174,192	155,270,840	148,809,057	136,098,681	117,113,940	115,615,782
Roumania	144,700	173,587	39,503,000	63,532,846	61,270,072	61,849,306	53,919,708	53,651,978
Iran	207,205	169,176	56,567,152	61,928,591	56,560,863	56,937,308	53,532,977	48,691,634
Netherlands India	149,206	131,043	40,733,446	47,961,744	45,307,913	45,107,828	41,234,498	37,988,913
Mexico	122,791	112,098	33,522,070	41,027,915	40,240,563	38,171,946	34,000,830	32,805,496
Iraq	83,702	81,730	22,850,640	29,913,150	27,410,983	7,639,849	1,094,915	871,840
Colombia	54,444	51,246	14,863,203	18,756,110	17,597,655	17,337,900	13,156,126	16,415,214
Peru	49,466	48,068	13,504,197	17,593,069	17,056,555	16,314,381	13,257,318	9,899,265
Argentina	42,383	42,235	11,570,488	15,457,960	14,297,025	14,021,901	13,690,556	13,138,747
Trinidad	41,973	36,167	11,458,792	13,237,030	11,671,224	10,894,363	9,561,353	10,126,121
British India and Burma	26,945	25,980	7,356,025	9,508,903	9,218,925	9,200,072	8,743,115	8,817,315
Bahrein	21,805	12,690	5,952,971	4,644,635	1,264,807	285,072	31,377	902
Poland	10,209	10,572	2,787,210	3,869,575	3,901,881	4,011,336	4,174,079	4,219,634
Brunei	12,138	9,009	3,313,680	3,269,938	3,302,905	2,705,350	2,035,656	1,200,026
Germany	8,458	8,389	2,309,158	3,076,858	2,967,438	2,204,402	1,656,602	1,594,807
Japan	7,883	6,568	1,851,933	2,403,072	2,294,878	1,872,837	1,504,412	1,683,439
Ecuador	5,949	5,308	1,624,258	1,942,467	1,731,785	1,636,619	1,619,902	1,597,641
Sarawak	4,434	4,507	1,210,570	1,547,882	1,776,593	1,942,591	2,206,815	2,329,733
Canada	6,923	4,110	1,890,023	1,504,287	1,447,204	1,410,895	1,145,333	1,044,412
Egypt	3,158	3,392	862,007	1,241,550	1,234,170	1,501,624	1,625,895	1,854,057
France	1,388	1,562	379,085	534,063	529,664	700,000	785,366	755,145
Czechoslovakia	330	346	90,040	126,603	136,580	177,797	121,695	126,533
Other Countries	1,025	969	280,000	355,600	398,800	430,200	391,500	370,700
Total	5,550,579	4,909,852	1,514,992,342	1,796,856,609	1,651,031,573	1,515,153,041	1,437,857,397	1,305,886,402

Foreign Oil Legion

"WE ARE definitely interested in Ireland, but it is impossible to say whether we will undertake or share in financing a refinery program there because no decision in the matter has been reached," said HARRY F. SINCLAIR, chairman of the board, Consolidated Oil Corporation, while attending the recent A.P.I. annual meeting at Chicago. This statement was in reference to the London rumor that Mr. Sinclair was associated with the men behind the Irish Free State national refinery project, which was discussed in the May issue of WORLD PETROLEUM. Mr. Sinclair recently flew from France to Ireland under most trying weather conditions with a pilot whom he later discovered had never made the trip before.

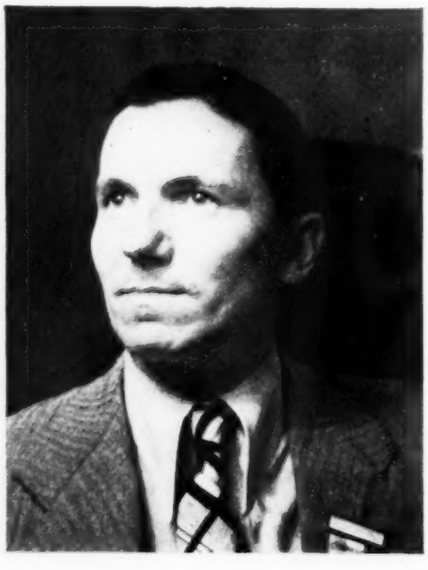
EDWY. R. BROWN, vice-president of Socony-Vacuum Oil Company Inc., and Mrs. Brown, received some unanticipated public attention upon their return to New York, November 11th, on board the BREMEN. Their reception began before they had arisen, when newspaper men swarmed up from the customs cutters. Yes, they replied, they had found the beds comfortable, the bathroom well equipped and its facilities in proper working order, the chairs substantial and the heat adequate—but why this sudden interest in their welfare? The answer is that Mr. and Mrs. Brown had occupied the suite which the DUKE and DUCHESS of WINDSOR would have used had they not canceled their American trip. Mr. Brown said that he didn't know how it was that he and his wife happened to be allotted the suite originally engaged by the Duke; arrangements had been made by the company's offices in Germany. When the ship docked Mr. and Mrs. Brown found the unsatiable autograph seekers on their doorstep, but with continued good grace obligingly signed their names.

B. A. MYERS, formerly general manager at the El Centro, Colombia, field of Tropical Oil Company and now director of International Petroleum Company, passed through New York November 6th on his annual inspection trip to Colombia and Peru. With Mr. Myers was F. BIMEL, also a director of International Petroleum.

LORD CADMAN of SILVERDALE, chairman of Anglo-Iranian Oil Company Ltd., recently described the way sharks are caught in the Iranian Gulf. The party sets out in a motor boat which, when the shark is located, is silently steered toward the black mass discernable a few feet below the surface. The man in the bow grasps an iron hook, 2 ft. 10 in. from barb to stem, and dives into the water immediately in front of the unconscious shark, stated Lord Cadman. Suspense—then a huge tail rises out of the water, lashes the surface into foam, and disappears in a swirl of bubbles as the shark plunges to the depths. Attached to the hook is a length of rope which has been secured to the boat's mast. With years of experience behind him the diver has forced the barb into the half-open jaws of the basking shark—which, suddenly realizing its danger, plunges and drives the hook in deep. The huge carnivour careens madly pulling the boat after it, while the dinghy is cast off for the diver, who has by this time returned to the surface some distance away.

MARIO CHIAPPONI, of the production staff of Societe Petrolifera Italiana at its Vallezza field, was among the guests at the banquet tendered visiting oil men at the Houston show. Mr. Chiapponi is in the United States studying production methods as applied by Humble Oil Company in its Texas and Mid-Continent operations.

Mario Chiapponi



J. N. Catinari

J. N. CATINARI, who has been purchasing representative Yacimientos Petroliferos Fiscales (Y. P. F.) in London for two-and-a-half years, is re-establishing his headquarters in New York adjacent to the offices of Ed. Wynne, shipping agent of the Argentine Government Oilfields. The New York establishment has been maintained by Y.P.F. for 26 years. Mr. Catinari, who arrived in the United States October 4th, says that the disturbed conditions in Europe are reflected in industry and that great difficulty is encountered in placing orders for refinery and pipeline equipment for immediate delivery. The amount of business which is being placed with European manufacturers under these conditions may be readily handled from New York, so the London office has been closed.

W. J. CAMPBELL, representative of Petroleum Machinery Corp., has returned from an extensive trip in the British West Indies and Eastern Venezuela. He left New York June 1st and returned October 14th, in time to attend the A.P.I. annual meeting in Chicago. Mr. Campbell visited all the oilfields in Trinidad and Eastern Venezuela, stopping over for some considerable time at Caracas and the Maracaibo basin. His company has become very active in that territory, handling construction as well as sales. While in Trinidad and Barbados he had a rather anxious time of it because of the strikes. Intending to stay in Barbados for a day, Mr. Campbell found himself dodging rocks for ten days before

he could leave the island. Following establishment of martial law, he says conditions immediately improved and although Trinidad is to a certain extent disturbed there is no likehood of a recurrance of the outbreaks in either colony. Mr. Campbell found conditions in Venezuela entirely satisfactory. He was particularly impressed by the progress made under the new government, and says the future holds great promise for the country.

KOJIRO MATSUKATA, president of The North Sakhalin Oil Company and former head of Kawasaki Dockyard, is staying at the Waldorf-Astoria in New York. Mr. Matsukata is a member of the good-will mission which is on a world tour to explain to various countries the Japanese viewpoint of the Sino-Japanese hostilities. He stated that the mission has no special itinerary in America and that he did not know how long he would be remaining in New York. Mr. Matsukata, who once studied at Yale, explained that he is visiting old friends and business associates.

George Vines

GEORGE VINES, general superintendant of production for Creditul Minier S.A.R. Petru Desvoltarea Industriei Miniere, of Bucarest, Roumania, has completed his visit to California, where he spent six weeks on a tour of the various fields, including Kettleman Hills, Bakersfield, Ventura and Los Angeles Basin. After attending the oil show in Houston in October he studied the Texas, Oklahoma and Mid-Continent fields prior to visiting Chicago in time for the A.P.I. annual meeting. Mr. Vines is scheduled to leave the United States via New York November 24th, on board the NORMANDIE, and will meet Mrs. Vines in Paris, where he expects to remain for two weeks before proceeding to Bucarest.

Russell Palmer (left), publisher of World Petroleum in New York and other oil journals in California and London, interviewing General Emilo Mola, famed Spanish military leader, on a recent trip through Nationalist Spain. The above is the last picture taken of General Mola before his death.

CRITICIZES PHYSICAL EXAMINATIONS FOR EXECUTIVES

COMMENTING on the announcement that executives of Standard Oil Company of New Jersey are to be physically examined at the company's expense each year, unless they object, RUSSELL PALMER, publisher of World Petroleum in New York and other oil journals in California and London, said when interviewed:

"It is to be hoped that no other large oil company will follow this example. Surely this is the ultimate in humiliation for business men of mature years who must either submit or leave themselves open to the inference that they are unfit. It is also a striking example of the tireless activity of those busybodies who stand between company earnings and stockholders.

"No executive can work well when worried. Physical worries are probably more formidable than financial ones. Few men reach executive positions in a great corporation with the organs of an insurance company 'average.' To take a group of men whose value to a company lies not in their gall bladders or kidneys but in their brains and accumulated experience and make them run an annual medical gantlet will not make them happier or more useful.

"Few men change their living habits after middle-life even when these are demonstrably injurious. To focus their attention on their physical shortcomings will, if it accomplishes anything, simply open the door to worry and to that preoccupation in impending dissolution which is the bane of middle life and leads to more breakdowns than to regenerations.

"The late William Howard Taft was once associated with a scheme of this sort and one of my highly prized possessions is a letter expressing regret that he had ever permitted himself to be drawn into it. The truth is that, while medical science has accomplished many wonderful things and its horizon is being broadened constantly it has not yet reached a point where it can accurately interpret all or even a large part of the information accumulated through these impertinent ransackings, and thoughtful doctors are the first to admit this. Until more progress has been made, this infernal snooping should be kept within the bounds of private policy.

"Who can tell but that a touch of liver in a company's publicity man may not actually make more earnings available for dividends and as far as oil companies are concerned some high blood-pressure in the sales department may be conducive to greater gallonage."

OUR FRONT cover shows Standard of California's wells at Huntington Beach. From further inland, wells were drilled directionally to cross under these wells and tap the submarine oil pool off shore. The photograph is reproduced through the courtesy of the Department of the Interior, Petroleum Conservation Division, under the direction of George W. Holland.

WORLD PETROLEUM ABSTRACTS

Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing With Technical and Economic Aspects of the Petroleum Industry. Edited by Dr. O. W. Willcox

PETROLEUM GEOLOGY

CARBON DIOXIDE ACCUMULATIONS IN GEOLOGICAL STRUCTURES—J. Charles Miller, in AM. INST. MINING AND METALLURGICAL ENGINEERS TECHNICAL PUBLICATION NO. 841 (1937).

Natural carbon dioxide has recently been exploited in the United States in consequence of oil and gas developments in the western states and the growing demand by transcontinental and transoceanic shippers for solid carbon dioxide. Discovery, by drilling, of commercial deposits resulted in consideration of its geographic and geologic distribution and occurrence.

Areas favorable to development of commercial production appear to be those in proximity to igneous rocks, or in the vicinity of decadent volcanic activity where it has long been known that the gas is evolved either free or dissolved in the waters of fumaroles, geysers, or mud pots. Structural contour maps are presented showing the Wagon Mound anticline in New Mexico and the Farnham anticline in Utah. A well, drilled on the latter, supplies gas to a 20-ton solid carbon dioxide plant at Wellington, Utah.

Before funds are invested in a plant for the manufacture of liquid or solid carbon dioxide, whether supplied by wells or springs, an effort to ascertain the volume of gas available is advisable. Use of present methods of estimation of gas reserves, with modifications to account for the quantity absorbed by any water present in the producing formation, is recommended. The Farnham anticline is used as an example and computations are made of the probable volume of gas originally present in the structure.

RECENT ADVANCES IN THE SEARCH FOR OIL IN AUSTRALIA—Arthur Wade, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

The search for oil in Australia is now confined to the margins of five basin-like areas of sedimentation on the Australian platform. These are:—

1. Great Artesian Basin occupying parts of South Australia, Queensland and New South Wales.
2. Sydney Basin of New South Wales.
3. Gippsland Basin, fringing the south-eastern coast of Victoria.
4. Desert Basin which is really the drainage basin of the Fitzroy River and its tributaries in the West Kimberly District of Western Australia.
5. North-West Basin which lies between the lower courses of the Ashburton and Murchison Rivers and fringes the western coast of Western Australia.

Sediments in the Sydney and Desert Basins range from Devonian through Carboniferous and Permian to Mesozoic deposits; the Great Artesian Basin, Carboniferous, Permian to Mesozoic; the North West Basin, Permian to Late Tertiary; the Gippsland Basin, Jurassic, Oligocene, Miocene to Pleistocene. In each of these basins floors of Pre-Cambrian rocks, granites, schists, quartzites, etc. have been proved by the presence of outcrops or by evidence provided by bores.

In the Great Artesian Basin well-defined closed structures have been found by the geologists of Oil Search, Ltd. and drilling is in progress on the Arcadia and the Hutton Creek domes, where the uncompleted tests have found gas. As a result of detailed geological work in the Sydney Basin wells are being put down on closed structures at Mulgoa on the Nepean river, and at Kulnura near Gosford in New South Wales. In the Gippsland Basin prospect drilling is in progress under the auspices of the Commonwealth and the Victorian governments working in cooperation. A well at Lakes Entrance is producing oil at the rate of 3 to 5 bbl. a day at a depth of 1,259 ft. In the Desert Basin devonian limestones have been found impregnated with oil at Price's Creek, where the drill has revealed bitumen and some gas; exploratory drilling is in progress on certain domed permian beds. In the Northwest Basin a number of anticlinal and domed structures have been mapped, but no drilling for oil has yet been undertaken.

The search for oil continues in the Australian dependencies of Papua and New Guinea. Geological work is being done by Oil Search, Ltd., in both areas. During 1936 companies associated with both the Standard Oil Company and the Shell Company entered the field and have sent out parties which include geologists, geophysicists and surveyors. It is too early to say more concerning this work. The geological work being done by Oil Search, Ltd., has reached an advanced stage but not so far advanced that drilling is to be undertaken in the very near future.

GEOPHYSICS

THE GRAVIMETER IN THE ALSACIAN SALT BASIN—Bernard Favre, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

This article summarizes the tests carried out by the Compagnie Generale de Geophysique with the Thyssen gravimeter in the region of Hettenschlag (Alsace).

Fifty-eight gravimetric measurements were made, covering an area of about 100 square kilometers. So exact are the measurements that the error in the determination of the variation of G between two points does not exceed 0.5 milligal. It was possible to trace the isogamms from milligal to milligal. Their outline agrees very well with the results obtained previously by means of the Eotvos torsion balance, and the resistivity method.

MEASUREMENTS WITH THE THYSSEN GRAVIMETER IN 1935/1937—A Schleusner, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

Gravimetric measurements are not only a substitute for regional pendulum measurements, but are also being used in increasing degree instead of torsion balance measurements.

The Thyssen gravimeter weighs about 15 kilograms (33 lb.), and measurements are usually made in the automobile which transports the party. Temperature coefficient is under most conditions so small that a temperature correction may be neglected. Field stations are directly related to the base station. Every measurement is repeated, so that sufficient material may be accumulated to guarantee accuracy of investigation. The average error lies between plus or minus 0.2 and 0.3 mgal. In comparison with this accuracy the most recent pendulum measurements show a range of error of plus or minus 2.0 to 2.7 mgal.

The field of use of the gravimeter is shown by a series of examples. Salt domes are sharply profiled so that size and position of dome can be accurately shown by the gravimeter. An outstanding advantage is the possibility of working in regions of irregular topography; on this account it has been possible to survey extensive regions in upper and lower Bavaria where use of the torsion balance was impracticable. An interesting example is the Aachen coal district where faults involving sand formations could be indicated.

FORMATION TESTING BY HIGH FREQUENCY CURRENTS—O. Martienssen, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

Some years ago the late Conrad Schlumberger devised an electrical resistance method whereby the charater and extent of geological formations penetrated by a drilled well could be more or less satisfactorily disclosed.

Cases arise where geological formations of very different natures have the same or very similar electrical resistances, so the Schlumberger method is not well adapted for an absolute characterization of the formations; on the other hand it serves very well for correlation purposes: equal changes in resistance in neighboring wells indicate similar changes in the character of the formations.

The high frequency method devised by the author is adapted partly to supplement measurements by the Schlumberger method, and partly to replace them. The new method differs from the Schlumberger method in that it measures electric capacities instead of resistance; that is, it substitutes the dieletric constant for the specific resistance, although in many cases the conductivity and the dielectric constant may vary in the same sense. In the case of oil, both are at a minimum and in the case of salt water both are at a maximum, but there are still differences which may be of importance. Thus, dry rocks and oil are both practically insulators, but the dielectric constant of the first is 6 to 8, and of the latter 2; salt water and fresh water have nearly equal dielectric constants, namely 60 and 80, but have very different conductivities.

Another fundamental difference in the two methods is that by the high frequency method it is possible to observe the presence of formations only a few centimeters thick, which would be overlooked in the resistance method. On the other hand the current used in the high frequency method penetrates less deeply into the formations. This is of importance with very porous layers and where formation pressures are low, in which case the drilling fluid may penetrate far into the formation and thus color the result.

In principle the high frequency method of characterizing geological horizons depends on the fact that the electrical capacity of a wire in contact with the earth depends on the dieletric constant and the conductivity of the intervening medium. If there-

fore a high frequency circuit (1,000,000 changes per second) includes a wire (an antenna or coil) the capacity of which is influenced or changed by the rock formations, then the frequency is altered and these alterations can be observed and recorded. Besides the change in frequency there is a change in current strength and this also can be recorded.

Before the method could be applied practically certain difficulties had to be surmounted. These have been overcome and there has finally been perfected a usable instrument, which is described and illustrated. Typical logs of wells surveyed by this method are given to show the differentiations that can be effected.

OIL WELL OPERATION

Extra Heavy Drilling Muds—Henry E. Gross, in MINING AND METALLURGY, vol. 18 (1937), No. 370, p. 467. (Author's title: Intensive Weighting of Petroleum Drilling Muds).

Areas of abnormal initial rock pressures have been drilled recently in the Gulf Coast of the United States, and fortunately the wells completed with surface pressures as high as 6,000 lb. per sq. in. have not blown out and cratered. A case is on record of drill pipe rotating for 8 hr. through blowout prevention rams holding a back pressure of 2,900 lb. per sq. in. after the mud was altered by salt water intrusion. Such conditions warrant the use of extremely heavy muds made from specially prepared mixtures of hematite (Fe_2O_3) and galena (PbS) suspended by bentonite.

A mud prepared from minus-325-mesh material in the proportion by weight of 35 percent galena, 35 percent hematite, 1.2 percent bentonite, and 28.8 percent water has a specific gravity of 2.4. It weighs 20 lb. per gal., and has a viscosity of 28 centipoise at 600 r.p.m. Stormer with fin. Tannic acid will not reduce the viscosity of this mixture.

If an identical amount of barytes ($BaSO_4$) is substituted for the hematite in the above mud, tannic acid will then greatly reduce the viscosity, and 0.1 percent by weight of tannic acid added to the mud will reduce the viscosity to 40 centipoise, other characteristics being the same as for the hematite-galena mud.

Since all galena muds are black in color anyway, the dark colored cheap hematite should be the preferred diluent.

Galena is the most abundant and cheapest of the intensive weight minerals of more than 7.0 specific gravity. In 1937 it is expected that 160,000 tons of the mineral will be produced in St. Francois County, Missouri. Annual capacity of the district is 200,000 tons of the mineral, a rate which would be maintained for years to come. Accordingly, 40,000 tons of galena could be avilable for mud weight purposes. At $85.00 per ton f. o. b. the Lead Belt, galena alone is too expensive, but a fifty-fifty blend with $12.00 per ton iron ore (hematite) would bring the cost within the range of usefulness. Abundant supplies of galena, barytes, and hematite are present within a 15-mi. radius in Southeast Missouri, and this area should be able to produce a plentiful supply of economical intensive mud weight blends for use in areas of abnormal pressure.

Water Withdrawal Rates as a Factor Influencing Pressure in the East Texas Field—S. A. Guiberson, Jr., in OIL WEEKLY, vol. 87 (1937), No. 3, pp. 17-18.

The author praises the conservation policy of the Texas Railroad Commission aimed at preventing dissipation of the formation energy that brings oil to the surface in the East Texas field. This policy is limited to regulating the rate of withdrawal of oil and gas and should be complemented by regulating the rate of water withdrawal. He propounds his theme in the following words:

"The time has arrived when a factor in conservation of the East Texas oilfield must be taken into consideration and that factor, unless controlled, will tear down all ability to maintain the flowing life of the field. That factor is the water withdrawal from the field. I maintain, and I defy anyone to contradict successfully my contention, that production of a barrel of fluid from that field, whether it be oil or water, has the same influence on the bottom-hole pressures.

"If the production of approximately 450,000 bbl. per day is the limit that will maintain present bottom-hole pressures, then any additional amount of fluid, whether it be oil or water, is bound to lower bottom-hole pressures. At present there are between 75,000 and 100,000 bbl. of water being pumped out of that field, and the result is a lowering of bottomhole pressures, corresponding exactly the same as though that additional water had been an equal amount of additional oil.

"In practice, what really is happening is this: by producing a very large amount of water from wells that normally would be flooded by the gradual water rise level, the water level around such wells and over the entire west, north, and south sides of the field is being held down so that the normal level of the oil is held down and the well continues to make its allowable of oil, but with as high as 1,000 or even 2,000 bbl. of water per day.

"It is easy to see that this is an ever increasing danger. More and more wells will start to produce water and more and more water will be pumped, resulting in the entire loss of the water drive."

Oil Well Behavior Study—H. C. Miller, E. S. Burnett and R. V. Higgins, in OIL WEEKLY, vol. 87 (1937), No. 1, pp. 30-46.

Study of the observed data on subsurface pressures opposite the productive sands and related production data on wells in the Kettleman Hills, Dominguez, Playa del Rey, and Padra Canyon fields, California; Hobbs field, New Mexico; Rodessa field, Louisiana; and East Texas field, Texas, shows a simple definite relation between the mass rate of fluid (oil, gas and water) production and the drop in pressure causing flow through the sands. When the mass rates of production for different rates of flow in a well are plotted on logarithmic paper against the difference between the average formation (static or shut-in) and flowing pressures opposite the producing sands, the relationship between them is represented by a straight line, which may be expressed mathematically by the equation:

$$M = C\,(P_f - P_s).$$

where M = mass rate of fluid (oil, gas, and water) production, lb. per 24 hr.

C = coefficient, numerically equal to the mass rate of flow of fluids per pound pressure drop through the sands.

P_f = average shut-in formation pressure opposite the producing sands, lb. per sq. in. abs.

P_s = average back pressure (flowing pressure) in the well opposite the producing sands, lb. per sq. in. abs.

Substitution of observed well data for the terms M, P_f and P_s in the equation permits calculating values for C, the productivity factor or index for the well, or both P_f and C may be determined by substituting numerical values of M and Ps at two or more rates of flow. The study indicates, for the range of production observed in the tests forming the basis of this report, that C is a constant in a given well for all rates of flow. In a number of wells, C did not change (within the limits of accuracy of the reported data) during an eight-month period while the wells were producing regularly or alternately flowed and shut in for periods of time. In a number of other wells C did not remain constant during an eight-month period. In those wells where C increased, the probable indication is that the wells were "cleaning themselves out" or that a readjustment of the sand particles immediately about the wells was reducing the resistance to flow of fluids into the well bores. When C decreased with time, or, in other words, when less mass of fluids entered the wells per pound drop in pressure through the sand, a condition of clogging at the sand face, or plugging of the perforations in the oil string, is suggested.

While these relations hold for the areas studied, the authors admit the possibility of discrepancies elsewhere.

Preparation of Flooding Water to Prevent Plugging the Oil Sand—Harry M. Ryder, in OIL & GAS JOUR., vol. 36 (1937), No. 19, pp. 80-82.

Production in the Bradford (Pa.) field is almost entirely based on flooding the oil sands with water. Success of this water drive depends on freedom of flooding water from substances that would plug the pores of the sand and thus interfere with the inflow. It appears that some producers are not clear as to how plugging may come about, or what would be suitable means for avoiding it.

Plugging of flooded oil sands may result from one or more of the following conditions:

Suspended matter (dirt) in the water. This is the most common cause of trouble, and may be removed by filtration, in some cases after treating the water with alum; however, unless competently handled the alum may make a bad matter worse.

Iron dissolved in the water; this can be got rid of by aerating the water and filtering or giving the precipitated iron hydroxide a chance to settle out.

Manganese dissolved in the water; making the water slightly alkaline with lime or soda ash will render the manganese harmless, and at the same time render the water non-corrosive to piping.

Slime, due to the growth of green algæ if the water is much exposed to light, or to certain white growths that form in the dark. The algæ may be taken care of by adding a small quantity of copper sulphate to the water, and, in cases where white growths are troublesome, by addition of a little sodium hypochlorite.

Corrosion of pipelines; besides causing early failure of pipes, corrosion may result in carrying solid material to the sand face. Corrosion is due to an acid condition of the water and may be corrected by adding lime or soda ash (if the additions produce precipitates, these must be filtered out).

Other substances that may cause plugging include salt waters that might react with minerals present in the sand; a high gypsum content is objectionable. Hydrogen sulphide, if present in the water, may react on the iron piping and release iron sulphide that can cause plugging, Such waters are to be avoided.

In any case, the flooding operator will be well advised to seek the advice of a competent water engineer.

NATURAL GAS

Panhandle Oil and Gas Field; Annual Report of the Railroad Commission of Texas, August, 1937, 40 pages.

This report shows that as of July, 1937, the Texas Panhandle field is producing 1,700,000,000 cu. ft. of gas a day, 385,000,000 cu. ft. of which is casinghead. The previous enormous wastage of gas was

reduced in June to 54,360,000 cu. ft. or less than five percent of the gasoline plant intake. The tremendous saving thus accomplished is reflected in the volume of gas taken by the carbon black plants, which has now increased to nearly three-fourths of the entire gasoline plant volume.

By statute, the producers were at liberty to blow 385,000,000 cu. ft. of casinghead gas into the air during June, 1937, but through commission orders, together with the intelligent co-operation of the operators, over 330,000,000 cu. ft. daily—86 percent of the total casinghead volume—was conserved and utilized by the industry. Such a degree of conservation and utilization of casinghead gas is unknown in any other field in Texas. The previous shocking waste of an irreplaceable natural resource is thus being corrected, and the commission freely acknowledges the helpful spirit of the operators in bringing about this very desirable result.

Due to arrangements in prospect the present wastage will be reduced by half by 1938.

At the present time there are 1,374 gas wells in the area; these wells have a combined potential of 22,990,282,000 cu. ft. daily. In July, 1935, the number of wells was only 1,109, with a potential of 18,606,868 M. c. f. The total gas area is now 1,460,080 acres. Nine major natural gas pipelines radiate from the field. There are 39 strictly natural gasoline extraction plants, exclusive of six plants which process pipeline light and fuel gas; in June, 1937, 73.8 percent of the residual gas from the natural gasoline plants goes to carbon black plants and only 4.9 percent was popped into the air.

Oil development was accelerated during the past year; new wells with an aggregate potential of 234,590 bbl. have been added to the field. Increasing efficiency in oil production is reflected by decrease of the average gas-oil ratio from 9,000 cu. ft. per bbl. in August, 1935, to 4,700 cu. ft. in April, 1937.

Even though the Panhandle is a comparatively old field, at the present time 200 wells are in the process of being drilled. The average Panhandle oil well has a daily producing capacity of 296.7 bbl. and an average per well allowable of 24.4 bbl., giving a field allowable of 81,400 bbl. daily; the per well acreage is 75.1 acres. Spacing custom has been one well per 10 acres, and in a few instances six wells per 80 acres. Eight refineries are located in the immediate area, and are making a 58 percent average recovery of gasoline from Panhandle crude.

As is well known, the Panhandle field comprises a sweet and a sour gas area. The line of demarcation is very sharp, though subject to slight fluctuations probably due to local withdrawal conditions.

Isolation of Pure Isomeric Hexanes from Natural Gas, including Determinations of their Physical Properties and the Phase-Equilibrium of Diagram of the Condensed System n-Heptane — 2-Methylpentane — by Johannes H. Bruun, Mildred M. Hicks-Bruun, and W. B. Mason Faulconer, Sun Oil Company Research Laboratory, Norwood, Pa. before PETROLEUM DIVISION AM. CHEM. SOC., Rochester, 1937.

Three of the isomeric hexanes have been isolated in a pure condition from natural gas by distillation in a 100-plate, all glass bubble-cap still.

It was found that some of the isomeric hexanes are, even when used in a pure condition, extremely hard to freeze because of their pronounced tendencies to form highly viscous, sticky, transparent masses upon cooling.

The freezing point of 2-methylpentane (99.99 mole percent pure) was found to be -154.0+0.05 deg. C., or 11 deg. C. lower than the generally accepted value. The 2, 3-dimethylbutane was found to freeze at -129+0.5 deg. C., or 6 deg. C. higher than the previously recorded value.

TRANSPORTATION

Installing a Section of Gasoline Line While Under High Pressure—D. L. Hines, in OIL & GAS JOUR., vol. 36 (1937), No. 19, p. 57.

A unique engineering problem was presented by an occasion which required cutting a six inch high pressure gasoline pipeline in order to relay the line under a road crossing. Ordinarily, this would be done by closing two main line gates miles apart, which involves flushing out the contents of the pipe with water, and which in turn would present grave disadvantages besides a considerable down time. To meet the situation an ingenious device was invented for opening up the line under pressure without allowing leakage; this includes a special fitting which is welded around the pipe, a cutting tool for severing the line, an instrument for forcing a rubber plug into the line, and an instrument for capping the line after the plug has been removed. The manipulations are described in detail.

In spite of the novelty of the situation and the means that had to be employed, the shut off was effected in four hours. A patent has been taken on the equipment.

It is contemplated that many occasions will arise on this and other pipelines which will call for the use of this equipment. It is especially acceptable on a line of the kind on which it received its first application, where filling of the line with water is objectionable, where long shutdowns are difficult to arrange, where line contents are hazardous, and where work must be carried on near highways or some other points of activity. Equipment of this type automatically becomes valuable in case of line failures.

Microbiological Aspect of Anaerobic Corrosion—H. J. Bunker, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

Character of the soil in which a pipe line is laid for the transportation of oil or gas is a matter that is usually looked into by a careful soil survey before the line is laid, so that due precautions may be taken against spots that could give rise to corrosion. Such points are usually associated with presence of acids or salts that could cause an acid reaction in contact with iron and oxygen. However, serious corrosion may result in situations where oxygen has no access, as when the line is buried in a dense clay soil containing no sulphides and no salts except neutral sulphates such as gypsum. Such soils may also contain organic matter, and in that case are practically sure to harbor micro-organisms of the anaerobic *Vibrio* type, which in the absence of oxygen are able to reduce sulphates to sulphides which attack and eventually destroy the pipe.

These same anaerobic bacteria are not infrequently responsible for sulphide corrosion of gas tanks with water seal, especially where the sealing water contains sulphates in solution. The action in such cases may and has even proceeded to the point where a perceptible quantity of hydrogen sulphide is introduced into the gas.

Corrosion of Metals in Soils as a Factor in Selecting Materials for Pipelines—Scott Ewing, before AM. GAS ASSOC., Cleveland, 1937; OIL & GAS JOUR., No. 20, 1937, p. 51.

Comparsion of the pitting rates of the wrought ferrous materials in the Bureau of Standards soil corrosion test with the chemical compositions of these metals indicates that increasing the content of phosphorous up to about 0.10 percent reduces the pitting rate slightly. Other alloying elements appear to have no effect on corrosion resistance. This is in general agreement with the A. S. T. M. results on the atmospheric corrosion of steel sheets differing in composition. The beneficial effect of copper, which was noted in the A. S. T. M. test, was not observed in the soil corrosion test.

Serious corrosion of copper is likely to occur in cinders and tidal marshes. Soils high in organic matter and alkali soils in which the ratio of chlorides and carbonates to sulphates is high corrode copper appreciably.

The corrosion of lead is practically negligible in soils high in sulphates and carbonates. It takes the form of pitting in soils that are about neutral in reaction (pH7) which contains very little soluble material, especially sulphates. In soils containing organic acids the attack is general (uniform corrosion) but the rate of penetration is rather low.

The effectiveness of zinc coatings and the poor protection afforded by lead coatings on steel is primarily due to the fact that zinc is anodic to steel and lead is cathodic.

REFINING

Continuous Purification of Residues—A. Pamula, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

A residual fuel oil containing water and solid impurities not separating by decantation, is purified in a continuous installation. This consists essentially of a Dubbs furnace installation where the residual is raised to 190 deg. It is then introduced into a column under 13 atmos. Decantation of the impurities is carried out at the lower end of this column, from whence they are removed to a furnace where they are heated at 240 deg.; the purification is finished in a second column acting under 0.1 atmos

Use of Copper Salts in Refining Lamp Oils—H. Roche, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

The author presents a simple and inexpensive method of sweetening and decolorizing kerosene in one operation. It consists in treating ordinary decolorizing earth with the necessary quantities of hot concentrated solutions of copper sulphate and sodium chloride. The earth is then dried at 110 deg. C. and crushed to pass a 200 mesh sieve. The resulting fine powder has a brown color which becomes yellowish green in contact with moist air. The most suitable proportions are 50 percent of active clay, 10 percent of copper sulphate crystals, and 40 percent of sodium chloride. One kilogram (2.2 bbl.) of this mixture will sweeten five metric tons of kerosine, but if used alone the oil will become yellowish green after a few days. The treated clay is therefore mixed with 25 times its weight of untreated clay, the mixture being used in the regular way by mixing with the oil and filtering. This method does away with all liquid doctoring agents. The author developed this process at the Pechelbronn (France) refinery.

De-Asphalting and Acid Treating in Propane Solution for the Production of Bright Stocks and Cylinder Stocks—W. H. Balke, E. W. Thiele, C. E. Adams and B. Ginsberg, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

Results are given of bomb experiments on the propane de-asphalting of Mid-Continent residuum of 298 and 546 Saybolt Universal viscosity at 210 deg. F. and on an 86 deg. F. melting point Mid-Continent residuum at various temperatures up to 193 deg. F. and propane ratios up to 11.5 to 1 by volume. Viscosity of the de-asphalted oil is mainly determined by the temperature, as is the yield, but below a certain critical temperature high ratios decrease the yield while above this temperature they increase it. High propane ratios always improve the color. Two stage de-asphalting has no value; counter current contact improves yield but does not affect quality.

Bomb experiments on de-asphalted oil showed that excellent green cast oils could be made with very little acid, provided that the propane contained

no unsaturates. Acid should be from 93 percent to 98 percent strength. No change in results was noted at treating temperatures between 0 deg. F. and 110 deg. F.

The considerations governing the design of the commercial plant at Whiting, Indiana, are discussed and the plant is described. About three parts of propane to one of oil are mixed at 100 deg. F. and settled in a horizontal drum. Acid is mixed with the light layer in two vertical drums in a two-stage countercurrent operation and the treated solution is neutralized with weak caustic solution and settled in another drum. Propane is distilled from petroleum asphalt and sludge, most being recovered at 200 lb. pressure without compression. The vapors from steam stripping are condensed in jet condensers and the propane recompressed. The asphalt must be fluxed with light oil, no high temperature steam being available. Corrosion is confined to the sludge stripper and accessories; for these lead lining copper-nickel or brasses must be used. Acid requirements and degradation of oil to sludge are about one-tenth those of the former process and utilities are much reduced.

Catalytic Purification of Gas Oils—Edouard Lege, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

Catalytic purification of gas oils consists in subjecting them to a kind of sulphuric cracking with sulphuric acid at a temperature maintained between 150 deg. and 250 deg. C., taking care to keep as constant as possible, the conditions of contact.

Gas oil, like all other hydrocarbons subjected to this treatment, is converted into: a very stable white oil, generally free from sulphur, of a density lower than that of the product originally treated; a very stable brown oil floating on the top of the acid, of a higher density than that of the product originally treated; carbon products, submerged in the acid, such as carbon, carbide, etc.; gas and wastes.

Sulphuric cracking carried out in this way, orients the treated hydrocarbons towards mono- and polycyclic naphthenic structures.

Hydrogenation of Cracking Residues to Produce Gasoline and Airplane Fuel—J. C. Flugter, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

Destructive hydrogenation of petroleum residues under high pressure can best be effected in two stages. In the first stage the base material is hydrogenated principally to gas oil (with small quantities of gas, gasoline and residue as by-products). The hydrogenation is done in the liquid phase, and in this process use has been made, at least up to now, of a finely divided catalyst. The gas oil thus produced undergoes a second hydrogenation in the gaseous phase in passing over a solid catalyst. By a careful selection of conditions and catalysts it is possible to obtain from a cracked Iraq oil, for instance, a maximum of 80 percent by weight (109 percent by volume) of a motor fuel with a C.F.R. octane number of 66 to 69, or a maximum of 75 or 76 percent by weight (104 to 105 percent by volume) of a C.F.R. octane number of 70 (after addition of 3.3 cc. of tetraethyl lead). This work was done on a semi-industrial scale for the Royal Dutch-Shell.

Characterizing Mineral Oils According to the Conditions of Their Distillation—A. Hanriot and R. Weick, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

A naphthenic residue containing no asphalt and from which volatile constituents boiling under 200 deg. C. had been removed, was subjected on the one hand to distillation with superheated steam to obtain as much as possible of the lubricating oil fraction, and on the other hand to straight distillation in a cathodic vacuum. The carbon tests and refraction index of the oil distilled in the cathodic vacuum were, at equal viscosities, sensibly the same as those of the oil obtained by steam distillation. This parallelism persisted up to viscosities of 100 deg. Engler at 50 deg. C. The identity of the characteristics of the distillate obtained by the two techniques indicates that the cathodic distillation of the crude oil is adapted to show the characteristics of the crude oil, as well as the possible yields.

In continuing the distillation of the crude with the idea of obtaining more lube oil, the relations of carbon test/viscosity and viscosity/refraction radically change and the oils are of poorer quality, and contain products of thermal degradation of the original oil. Hence the graphic representation of these two sets of ratio, which can conveniently be drawn from the results of a cathodic vacuum distillation, will be extremely useful for controlling the distillation of a crude oil and the quality of lubricants obtained from it.

New Scope for Cold Acid Treatment of Cracked Naphtha—C. W. Stratford, F. G. Graves and E. S. Brown, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

The study of gasoline refining by means of acid has shown that in every individual case there is a maximum temperature beyond which the economics of the operation are unfavorably affected. This optimum temperature, which must be predetermined in each case, will lie somewhere between 20 deg. F. and about 60 deg. F. The great savings that may be accomplished by a temperature control within these limits will readily be appreciated if the results of refining above and below 60 deg. F. are compared. In their paper the authors make this comparison by means of graphs which show the relations between temperature, amount of acid required, refining losses, polymerization losses and the decrease in octane number. After emphasizing the importance of controlling the temperature, time of contact, dispersion and separation of the acid, they show how these different conditions are realized in the most recent installation for cold acid refining, with description of the necessary equipment.

Purification of Gasoline by Copper Salts—Wayne L. Benedict, C. G. Dryer, J. C. Morell and Gustav Egloff, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

A sweetening process employing a solid mixture of cupric sulphate, ammonium chloride and a carrier such as fullers earth, fire brick and similar material was found to be commercially applicable to straight-run, natural and cracked gasolines. No elementary sulphur is used in the copper sweetening process. Emulsion formation and consequent losses entailed in plumbite sweetening are eliminated. The sweetening operation was simplified by the elimination of intermediate settling, and of the problem of disposal of spent alkaline solutions. The process is continuous and regeneration of the copper reagent is readily accomplished by continuous addition of air to the gasoline being sweetened, or by periodic blowing of the reagent with air. Properties of gasolines sweetened by the copper process are superior to the corresponding plumbite sweetened gasolines. Color stability, induction period with and without inhibitor, octane rating and susceptibility to tetraethyl lead of copper sweetened gasoline were found to be superior to corresponding plumbite sweetened gasoline. Haze formation was minimized or eliminated.

Preparation of Lubricating Oil by Direct Refining of Residues with Adsorbing Agents—C. Creanga, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

Viscosity tests on mineral lubricating oils give evidence of the advantages of using undistilled crude oil as the sole base for preparing lubricants. The proposed method is based on the use of the adsorbent properties of porous media, under novel conditions, for the refining of crude oil. Since the adsorbent action of earths is controlled by the intimacy of contact between the oil and the porous medium, attempts have been made to realize the conditions most favorable to this contact, by total absorption of the crude in the pores of the medium. The resulting powder when extracted with gasoline or light spirit allows the complex mixture of hydrocarbons to pass into solution while retaining by adsorption the deleterious portion. By removing the solvent a refined oil is obtained, which requires no further treatment, except perhaps for distillation to the required grade.

Use of this method of refining a series of non-paraffinic Roumanian crudes has allowed the author to obtain various lubricating oils, the properties of which are shown in the tables attached to the paper. The profitable yield and superior quality of the oils obtained apparently give proof of the advantages of the proposed process. (The author is chief chemist of the Roumanian Geological Institute).

Recovery of Mercaptans from Cracked Naphtha Fractions—by R. W. Crary and M. M. Holm, Standard Oil Company of California, before PETROLEUM DIVISION AM. CHEM. SOC., Rochester, 1937.

Equilibrium data are presented for absorption in caustic and methyl and ethyl mercaptans from the corresponding cracked naphtha fractions. Similar data are given for removal of the same mercaptans from caustic solution by steam stripping. The data are correlated by means of equations derived from the equilibrium constant for the neutralization reaction. Application of the data to the design of commercial equipment is discussed.

Methods for Preventing Corrosion from Mid-Continent Oil—Robert E. Puckett, in OIL & GAS JOUR., vol. 36 (1937) No. 19, pp. 44-48.

Kansas refiners have been called on, with some suddenness, to face serious corrosion problems due to change in the character of crudes. In the Wichita plant of the Barnsdall Refining Corporation the most efficient means of removal of corrosive salts in crude oil was found to be water scrubbing followed by electrical dehydration. Ammonia gas was of great assistance in the control of sulphur and acid corrosion in crude stills and in low velocity cracking stills. Contrary to the recommendation of the ammonia manufacturers who state that the gas is decomposed at around 800 deg. F., the gas is injected into the cold crude charging pump, with excellent results. An unexpected result was that amino compounds of high boiling range were formed which gave an alkaline reaction to the topped crude. When this fuel was rerun in the Dubbs cracking still the amino compounds gave almost complete corrosion prevention. The cracked pressure distillate was definitely alkaline. Even the coke from these units was definitely alkaline and gave a positive test for ammonia. Replacement of tubes in the Dubbs plant dropped about 75 percent. To accomplish these results required about 8 lb. of ammonia per 1,000 bbl. charged through the crude stills. Similar results can be obtained under similar circumstances by injecting ammonia into the crude furnace.

A controlled lime dosage has given excellent protection in high pressure cracking equipment.

Hydrogenation of Olefine Polymers for Manufacture of High Octane Motor Fuel—C. L. Brown and E. J. Gohr, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

Availability of large quantities of iso-octane has made possible the commercial manufacture of an aviation fuel of very high anti-knock quality which corresponds to the general specifications for this grade; it is prepared by mixing iso-octane with

natural gasoline with addition of 3 cc. of ethyl lead per gallon.

The authors describe the process of manufacturing technical iso-octane, which consists mainly of 2.2.4 trimethylpentane; it is produced by hydrogenation of the co-polymers normal butene and isobutene. In comparison with ordinary anti-knock motor fuels this mixture has the advantage of greater power and a lower consumption per mile.

For more than a year the factory at Baton Rouge, La., has been hydrogenating di-isobutene by the ordinary hydrogenation technique; for this purpose use is made of hydrogen (95 percent pure) which is produced by the transformation of gaseous hydrocarbons, and a pressure of about 200 atmos. is employed. The hydrogenation reaction is strongly exothermic, but the temperature is controlled by introducing fresh gas at different points of the catalyst. Reaction is carried out in two chambers connected in series.

The catalyst now in use at Baton Rouge has already survived more than 5,500 hours of operation.

Hydrogenated polymers, in addition to their high anti-knock quality, are distinguished by the great sensitivity to lead possessed by their mixture with natural gasoline. The laboratory is continuing research on the hydrogenation of different olefine polymers.

Production of Aviation Fuels by Hydrogenation Under High Pressure—C. L. Brown and E. J. Gohr, before second world petroleum Congress, Paris, June, 1937.

Rising consumption of aviation gasoline of high anti-knock quality, and which at the same time has the required volatility and chemical stability, can be met only by the introduction of new methods of manufacture. With the classical formula which calls for mixing straight run gasoline with lead or benzol it is difficult to attain an octane number of 90, or even 80.

The problem can be advantageously solved by a hydrogenation effected under the following three general principles:

1. A hydrogenation at moderate temperatures in presence of the new catalyzers that have a selective de-hydrogenating action allows of the transformation (with good yields) of products of aromatic nature into anti-knock gasoline with an octane number of 75 to 78; this gasoline is practically free from sulphur and olefines. It has a good sensitivity to ethyl lead; by adding it and ethyl lead to natural gasoline there is produced a motor fuel which is much superior to natural gasoline and is excellently adapted for compounding the so-called 100 octane, army type aviation motor fuel.

2. High temperature hydrogenation, which was known before the introduction of selective catalysts, allows of hydrogenating various raw materials, especially those of aromatic nature, to produce a hydrogenated aromatic gasoline having an A. S. T. M. octane number of 81 to 87, which is somewhat less sensitive and can easily be stabilized by inhibitors. These gasolines are preferably mixed with natural gasoline, which increases their content of the lighter components.

3. Hydrogenation of polymerization olefines with branched chains, such as di-isobutylene, results in the production of technical iso-octanes.

Miscibility Relations in Solvent Dewaxing—F. W. Hall and B. Y. McCarty, before second world petroleum congress, Paris, June, 1937.

The solvent dewaxing process in its present commercial application employs a mixed ketone-benzol solvent. The ketone content, or anti-solvent, insures complete precipitation of the wax at a temperature closely approaching the desired pour point of the dewaxed oil, and the benzol, or oil-solvent, insures complete solubility of the wax-free oil at the same temperature. The proper solvent composition, therefore, involves a balance between wax precipitation and oil solubility.

In order to avoid oil separation at the dewaxing temperature, it is necessary to have a definite knowledge of the solubility relationships of both the wax and oil under varying conditions of solvent composition and dilution.

A method has been devised for the investigation of wax and oil solubility relationships whereby the desired data are readily obtained and the resulting information is of definite value in the application of the process to oils of varying characteristics. (For another method of obtaining this information see abstract of paper by Spack: "Estimation of Paraffin in Petroleum Products."—Ed.)

By means of cloud point determinations it is possible to establish the temperatures of initial separation of both wax and oil under varying conditions of solvent composition and dilution, which, when plotted graphically, permit determination of the temperatures of separation, benzol freezing temperatures, the differential between dewaxing temperature and dewaxed pour point, and an approximation of the solvent composition of the separated liquid phases.

In cases of extremely low oil solubility, a portion of the benzol is replaced by toluol. A mathematical relation has been derived to calculate the effect of increased toluol content on the lowering of the oil separation temperature.

Material balances on small scale dewaxing experiments provide an accurate method of determining the relationship between wax content and pour test which may be extended to establish a relation between slack wax melting point and dewaxing yield.

PETROLEUM CHEMISTRY

New Reaction for Unsaturated Hydrocarbons or Their Peroxides—E. L. Lederer, before second world petroleum congress, Paris, June, 1937.

The new test is carried out as follows: a small quantity of the liquid hydrocarbon (or its melt in the case of a solid substance) is mixed with an indifferent solvent, a pinch of a dry manganese salt is added and the mixture warmed for ten minutes in a water bath or over a free flame. If unsaturated hydrocarbons are present the mixture will take on a brown color, the intensity of which will be proportional to the amount of unsaturates present, so that the phenomenon may be made the basis of a colorimetric method. Positive reactions are obtained with unsaturated open chain hydrocarbons, unsaturated cyclocompounds and hydroaromatics. Certain organic acids that are more dissociated than the manganese soaps formed in this reaction do not react. In place of manganese a cobalt salt may be used but the former is preferable.

Alteration of Aviation Motor Oil in Use, and Methods of Testing—Von Philippovich, before second world petroleum congress, Paris, June, 1937.

The tendency of an oil to cause sticking of the piston rings lies in its susceptibility to oxidation and to formation of asphalt and carbon under the conditions prevailing in the engine. Various methods of examination for evaluating this tendency are in use, with more or less satisfactory results. These methods do not yield comparable results when all are applied to the same oil. (The methods referred to are the British Air Ministry test, the French Air Ministry (Damian) test, the Indiana test, the Sligh test, and the Evers and Schmidt test.) The discordance between these tests arises from their different approaches, involving temperatures that are too low, oxidation in the liquid, disregard of volatility, estimating consumption of oxygen instead of examining the products of oxidation, measurement at a single temperature, etc. In general, most of these methods aim at the simultaneous determination of several allegedly critical characteristics, instead of evaluating a single dominant factor.

Departing from the usual run of methods the D V L has worked out a simple process the basis of which is the oxidation of oil by air in a thin layer at different temperatures, the changes in the oil being determined by changes in weight of the sample and a determination of the quantity of asphalt formed in the residual oil. The method is thus free from complications, requires simple apparatus, consumes little time and uses only small quantities of oil (10 grams). The results are expressed by two curves, one showing the volatility, and the other the asphalt content, both as a function of temperature. The definitive testing of this method is not yet completed.

Sulphonation of the Naphthenic Acids—W. Kisielewicz, S. Pilat, and J. Sereda, before second world petroleum congress, Paris, 1937.

The authors have summed up the contradictory data of the literature of the sulphonation of the naphthenes and examined the reaction between fuming sulphuric acid and naphthenic acids of various molecular weights. They have established that the higher the molecular weight the easier the sulphonation. When the molecular weights are equal, those naphthenic acids having the higher density and the higher refractive indexes react the more easily. Sulphonation of naphthenic acids is not necessarily followed by the exit of the carboxyl group and during the sulphonation the reaction develops only a small quantity of carbonic acid, which is most probably due to a secondary oxidation reaction. Fuming sulphuric acid removes naphthenic acids almost completely from the oil during the refining process.

Composition of Primary Polymerization Products of Propene and Butenes—H. Hoog, J. Smittenberg and G. H. Visser, before second world petroleum congress, Paris, June, 1937.

The gaseous olefines, propene, and two normal butenes and isobutene were polymerized singly or in mixtures by leading them over a solid phosphoric acid catalyst. The polymerization products were hydrogenated and analyzed. From the results the authors deduce what appear to be some general rules affecting the polymerization of these olefines.

The first conclusion is that the quaternary carbon atoms do not lend themselves to a polymerization reaction, but a molecular regrouping may easily occur that will produce a tertiary carbon atom. The second is that carbon atoms of the same status show little or no tendency to unite. The third is that the most favored combining reaction is between tertiary and primary carbon atoms.

The above rules are especially likely to be upset at higher temperatures which promote secondary reactions.

Chemicals Derived from Pentanes—Pat Kendall, before second world petroleum congress, Paris, June, 1937.

Chlorination of a mixture of normal pentane and isopentane according to the process of the Sharples Solvents Corp. gives a mixture of several monochloropentanes which cannot be separated. Investigation of the amyl alcohols formed by hydrolysis of the monochloropentanes gives an approximate idea of the composition of this mixture.

From the amyl alcohols obtained by the above mentioned hydrolysis esters may be prepared, the most important of which are the acetic esters known as pentacetate and pentasol. The amyl mercaptans are interesting products which can find use as malodorants for imparting a smell to propane and butane.

Mono, di, and tri-amyl amines are also produced. The monoamyl amine is a strong base and forms salts with fatty acids, which have outstanding emulsifying properties. The monoamyl amine is

soluble in water and also in the organic solvents related to pyridine.

From diamylamine nitrosamines may be made, which possess the property of protecting metal from the action of hydrogen sulphide.

Decomposition of chloramylene gives a mixture of two pentanes: 1—pentane and trimethylethylene. By condensation of trimethylethylene with phenol in presence of sulphuric acid there is obtained a p-amylphenol, which when condensed with formol gives a resin soluble in oils that is very stable toward light and weathering.

By-products of the chlorination of pentane are dichloropentanes, which are excellent solvents for rubber, fats, resins and pitches.

CATALYSIS IN THE PETROLEUM INDUSTRY—V. N. Ipatieff, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

The increased demand for gasoline has required extension of the cracking process to the heavier fractions. Further means of increasing gasoline production lies in polymerization of the olefines contained in the gases from the cracking process. The author has calculated that if these olefines were all subjected to polymerization the output of gasoline in the United States could be increased by five percent. The gasoline so produced would have the advantage of a high octane number. In order to utilize the saturated hydrocarbons present in the cracking gases these latter could be first dehydrogenated and then polymerized.

Polymerization of olefines results in various products: polymer olefines, naphthenes, aromatic hydrocarbons and paraffinic hydrocarbons. The author has tested catalysts that force the reaction to exclusive production of polymer olefines. By polymerization of propane at 200 deg. to 225 deg. C. in the presence of orthophosphoric acid as catalyst there was obtained a mixture of di-, tri-, and tetra polymers. The opinion is expressed that further systematic study should lead to the discovery of catalysts capable of directing polymerization toward specific products.

DETERMINATION OF HYDROGEN SULPHIDE CONTENT OF GAS IN THE FIELD—R. M. Lilly and N. P. Chesnutt, in OIL AND GAS JOURNAL, vol. 36, (1937), No. 14, pp. 52-62 and 70.

Where hydrogen sulphide in natural gas has to be determined under field conditions the existing methods, which were mostly designed for use in permanent and conveniently furnished laboratories, are far from satisfactory. What a field operator needs is at least one standard solution that is permanently stable, which is not the case with the iodometric methods; or a method which avoids filtration of a precipitate, which is not the case with methods involving use of silver or cadmium salts.

After much research the authors have decided on titration with ceric sulphate, $Ce(SO_4)_2$, which is reduced by hydrogen sulphide to $Ce_2(SO_4)_3$, and has the advantage that its solutions are permanently stable, non-volatile and unaffected by light, air or carbon dioxide. The procedure consists in drawing a measured quantity of the gas through an acidified standard solution of ceric sulphate, and titrating with tenth-normal ferrous solution in the presence of ortho-phenanthroline ferrous complex indicator; the end point is an intense red color which cannot be missed. As described, the method is both accurate and convenient.

HYDROGENATION OF ROUMANIAN PETROLEUM—C. Candea and A. Marschall, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

The author examines the hydrogenation of petroleum products:—gasoline, kerosene, crude petroleum freed from or containing gasoline, and other mineral oils.

Research has been carried out employing MoS_3 as a catalyst in an autoclave to investigate the conditions of temperature and pressure which would give a higher yield of gasoline as well as an improvement in the quality of the products of hydrogenation. It has been established that the process of hydrogenation does not depend entirely on temperature and pressure but also upon the chemical composition of the primary product.

In the presence of MoS_3 the most favorable temperature is between 300-350 deg. C., and the most favorable pressure is between 200-300 atmos.

Under these working conditions a yield of up to 50 percent of gasoline (distilling to 150 deg. C.) is obtained, the period of heating being one hour.

The percentage of non-saturated hydrocarbons in the gasoline obtained is reduced, whilst the percentage of aromatics and naphthenes increases, especially at higher temperatures and pressures. In the same way the formation of coke is proportional to the pressure, decreasing at higher pressures. The percentage of sulphur in hydrogenated gasolines is low. Gasolines obtained by hydrogenation are of a saturated type, and are very resistant to oxidation and have a low tendency to gum formation.

Hydrogenation is clearly indicated for the transformation of petroleum products of low value into good quality benzene. In addition there are possibilities of obtaining the necessary hydrogen under very economic conditions from petroleum gases.

PETROLEUM PHYSICS

GRAPHS FOR READING VISCOSITY INDEXES—Roegiers, before SECOND WORLD PETROLEUM CONGRESS, Paris, 1937.

Dean and Davis have established charts giving the viscosity index of an oil when its Saybolt viscosity at 210 deg. F. and 100 deg. F. are known. These viscosities and temperatures are only current in America. The author gives charts based on the temperatures and viscosities employed in Europe; these enable the viscosity index of an oil to be found when its Engler or CST viscosities at 20 deg. C. and 100 deg. C. or at 70 deg. F. and 200 F. deg. are known.

CRITICAL TEMPERATURE OF DISSOLUTION OF MINERAL OILS IN ACETONE—E. Vellinger, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

The c. t. d. of mineral oils in acetone has been examined as a function of the origin of oils and of their degree of raffination or alteration. Refining raises the c. t. d. Alteration of normally refined oils has no influence on the c. t. d. Alteration of the over refined oils causes a very great diminution, which is produced by the reaction products. Diminution caused by the presence of alcohols and acids formed during the alteration process increases with the molecular weight of these bodies.

REFRACTOMETRIC STUDIES ON HYDROCARBONS—Willy Bielenberg, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

In mineral oil investigations the refractive index is almost always determined, but usually without any appropriate use being made of the characteristic figure thus obtained. As a matter of fact, the n_D value is influenced by the temperature (which can be controlled) and by the structural constitution and the molecular weight; consequently a direct evaluation of the significance of this constant is not possible. The mol.-wt./n_D diagrams heretofore proposed, taken in connection with other characteristics of the oil according to the classes of hydrocarbons represented in it, do allow of a more or less accurate description of a given oil. However, the molecular weight cannot be clearly established even for closely separated fractions of distillates, because the boiling points of individual isomers sometimes differ widely.

The author proposes to write the refractive index over the boiling point instead of over the molecular weight. And since differences in constitution are more sharply expressed in the dispersions than in the refraction, additional diagrams are drawn in which the dispersion (n_F-n_C) or the quotient $n_D(n_F$-$n_C)$ is written over the boiling point. The resulting diagrams then show a very clear separation of the different hydrocarbons. The quotient referred to shows the same independence of the constitution as the so-called Abbe number. (n_D-1) n_F-n_C). This affords a possibility of an analytical characterization of mineral oils on the basis of optical data in conjunction with other methods, such as the system proposed by Marder.

VISCOSITIES OF PURE HYDROCARBONS—W. R. van Wijk and J. M. Versteeg, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

To broaden the knowledge of the viscosity of liquids, viscosities of a number of pure hydrocarbons were determined at different temperatures.

These figures, complemented by those found by some other investigators have shown that, at the same density, the viscosities of branched-chain hydrocarbons are mostly higher than those of the corresponding normal hydrocarbons but that in certain cases they may be lower. Viscosity of the normal hydrocarbons, considered as a function of the specific gravity, appears to attain a minimum in the region of octane. Viscosities of normal hydrocarbons, from pentane to tetradecane, compared at the same specific gravity, vary by only 5 0/0.

ESTIMATION OF NORMAL AND ISOBUTANE IN MIXTURES OF THESE TWO GASES—Woog, Rene Sigwalt and Andre Gomer, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

Gaseous mixtures of butane and isobutane, on compression at constant temperature give volume/pressure curves of a different character, according to their composition.

The method described is based on this observation. After having determined at a given temperature the volume/pressure curve of the mixture which is being studied, this curve is compared with a system of curves which has been established from synthetic mixtures of these two gases, the composition of the mixtures being known: the composition of the unknown mixture can thus be identified.

CONTRIBUTION TO THE VISCOSITY-TEMPERATURE FUNCTION—E. L. Lederer, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

The author shows for the first time, that the decrease of slope, or the second differential coefficient of the viscosity-temperature relation, is a good characteristic of viscosity curves.

It turns out that $\log = a/T - b$, in which a and b are constants and T the temperature. This relation is of such closeness that in a series of measurements showing deviations, the magnitude of the experimental error can be determined. Since there is a simple relation between a and the molecular weight M, conclusions can be drawn from the ratio a/M regarding the constitution of individual liquid hydrocarbons. Setting up of a general formula for the analysis of mixtures of oils must, however, await the accumulation of further experimental data. The author also discusses the theoretical bases of pole height.

FLOW RESISTANCE OF LUBRICATING OILS AT LOWER TEMPERATURES—S. Erk, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

Flow resistance of lubricating oils at low temperatures determines the power required for starting an engine and for maintenance of lubrication, and this is true both of gravity lubrication and pressure lubrication. Existing methods of testing lubricating oils are inadequate in so far as they only consider a part of the mechanical requirements.

By making an extensive use of the microscope in studying the freezing of oils, the author finds reason to emphasize the distinction between that quality of the oil concerned with starting, and that

quality concerned with lubrication. This examination shows that the solidification begins with the crystallization of paraffin, when the oil loses fluidity. The formation of this crystal skeleton immediately imposes a considerable resistance to movement of the surfaces separated by the oil film, hence there is trouble in starting. Once the skeleton is destroyed by pressure or other mechanical means the fluidity is in large part restored; the oil will then flow under pressure, though its viscosity is still dependent on the degree of internal shearing.

Practical result of the author's microscopical studies is to emphasize the fact that determination of the point of solidification of an oil is no measure of the flow resistance; at most it is an indication of starting difficulties and the probability of the clogging of lubricating or fuel oil systems. The influence of crystals on flowability of oils is demonstrated by a capillary viscosimeter to which varying pressure can be applied.

ASPHALT AND TAR

Physical-Chemical Researches on Bitumen Emulsions—E. Vellinger and G. Radulesco, before second world petroleum congress, Paris, June, 1937.

Degree of dispersion of a bitumen emulsion varies as a function of the pH of the aqueous phase, and the maximum of dispersion corresponds to maximum stability; this means that the stability varies with the mean diameter of the globules of bitumen as a function of the pH, but is greatly affected by presence or absence of emulsifiers. For instance, the stability of a Panuco bitumen without emulsifier or softener lies within the pH limits 10.2-12.5. When emulsified with 0.9 percent of olein the stability limit is found within pH 8.1 and 12.6. Other properties, such as viscosity and rupture point, are also affected by the pH. Control of viscosity by the pH has some practical difficulties; it is better to employ such materials as stearic acid or sulphonic acids. For influencing the rupture one may add to the emulsions certain salts which have the effect of partially neutralizing the electric charges on the globules of bitumen. Finally, the stability of the emulsions in storage is the greater the smaller the average diameter of the globules of bitumen.

New Methods for the Examination of Liquid Asphaltic Bitumens—M. C. Siegmann, before second world petroleum congress, Paris, June, 1937.

Two new methods of examining cutbacks and cutback-containing mixtures are described. The one method relates to making an extract and separating the extracting agent by fractional distillation under conditions that will leave the properties of the cutback practically unchanged; carbon disulphide is used for this extraction instead of chloroform. In the other method the cutback that has been recovered by the preceding extraction is separated into bitumen and fluxing agent by distillation with superheated steam. The temperature of this steam distillation is of importance because cracking of the volatile constituents of the bitumen must be avoided. This detail is taken care of as follows:

A.—If the cutback has the smell of creosote oil, an evaporation test is carried out (one gram in a brass dish nine cms. in diameter) for five hours at 163 deg. C. The distillation (in accordance with C) is then carried out at 225 deg. C. with ten times the amount of steam calculated on the quantity of solvent indicated by the evaporation test.

B.—In the absence of a creosote oil smell, two evaporation tests are carried out, one for five hours at 100 deg. C. and another for five hours at 163 deg. C.

I) If only a slight difference between the results of these two tests is found (1 percent loss on heating), the solvent probably consists of kerosene (or gasoline) and the steam distillation takes place at 200 deg. C. (10 times the amount of steam calculated on evaporation loss at 100 deg. C.).

II) If the evaporation tests at 100 deg. C. and 163 deg. C. show a greater difference than 1 percent, a heavier solvent than kerosene is likely to be present, and distillation is effected at 225 deg. C. with 10 times the amount of steam calculated on the evaporation loss at 163 deg. C.

If it appears during the A.S.T.M. distillation of the separated solvent that another solvent is present than was expected, the steam distillation should be repeated at the correct temperature, namely:

At 150-200 deg. C. for gasoline.
At 200-220 deg. C. for kerosene.
At 240 deg. C. for gas oil.

Penetration Test of Asphalts—Paul Woog, Jean Givaudon and Louis Daulin, before second world petroleum congress, Paris, June, 1937.

The authors obtained irregular results when making penetration tests on asphalts by the method prescribed in the A.S.T.M. Standards on Petroleum Products and Lubricants, edition of Sept. 1936, p. 233. In tracking down the source of these irregularities they find it in the method prescribed for fusing and cooling the sample; a suitable procedure is described as follows:

Weigh 100 grams of the tar or asphalt and melt it in a porcelain dish for 30 minutes in an oven at 160 deg. C. (time and temperature depending on the hardness of the material); pour the melt into the testing cup and place the cup (uncovered) in a dust-free place on a support that will allow the fullest possible contact of air on its outer surface. This air-cooling should occupy exactly 60 min. and the temperature of the surrounding air should be between 18 and 25 deg. C. Then place the cup in a thermostatic water bath for one hour at a temperature of 25 deg. $\pm$0.1 deg.; during this bath-cooling it is indispensable that the water bath be continually stirred to assure an even temperature. Thereupon the penetration test is made as usual.

The unsatisfactory results from the A.S.T.M. method lie in the insufficient control of the conditions affecting cooling in the preliminary preparation of the sample.

Adsorption of Bitumens by Road Aggregates—J. R. Ramchandani, in J. inst. petroleum technologists, vol. 23 (1937), No. 166, pp. 491-505.

One of the important factors which distinctly influences the individual constituents and directly affects the mechanical properties of the final mixture has remained practically unrecognized outside the laboratory and insufficiently and vaguely comprehended within it. This factor is the phenomenon of adsorption.

It has been frequently observed that different kinds of road aggregates exhibit a markedly preferential affinity towards certain types of bitumens—for example, Penmænmawr stone has greater "bitumen-carrying capacity" than Mountsorrel stone. This has never been fully and scientifically explained.

The object of this paper is to investigate this preferential behaviour and explain it in terms of adsorptive capacity of the aggregate.

After studying the published work on the subject, it would appear that the measurement of adsorption calls for two fundamental considerations:—

A. Accurate determination of the surface area of aggregate;

B. Exact determination of the quantity of adsorbed bitumen.

The laboratory procedure requires measuring particle size and the adsorptive force between bitumen and aggregate. The author describes these methods and gives extensive observations on their use and results, which are represented by graphs, At the end he reaches the following conclusions:

(1) The determination of the adsorptive capacity of any road aggregate is an essential preliminary to its use, in view of the fact that the phenomenon of adsorption exercises a deep influence on the behaviour of bituminous pavements.

(2) Adsorption being fundamentally a surface phenomenon, the accurate determination of the surface areas of the aggregates is vital.

(3) An absolute and reliable order of adsorptive capacity can be established for road aggregates.

(4) Adsorption increases with the concentration of the bitumen solution to a limit of about 2 grams per litre.

(5) The assumption that adsorption is independent of the mineralogical and chemical composition of the aggregate is in part confirmed.

(6) The disperse phase of a bitumen (asphaltene) is more strongly adsorbed than the dispersing medium (resins and inert oils)— that is hard bitumens are more strongly adsorbed than the soft bitumens, which generally contain a small percentage of asphaltenes.

The technique adopted has established a method of assessing the value of an aggregate in terms of its power to adsorb a bituminous binder. The extended use of the principle and its expansion to cover all materials in regular use must lead to a marked advance in the construction of the asphalt road surfaces, and give a corresponding increase in their resistance to the destructive effects of traffic and weather.

USE OF PETROLEUM

Determination of the Tendency of Motor Fuels to Vapor-Lock—P. Woog, R. Sigwalt and Mlle. de Moulliac, before second world petroleum congress, Paris, June, 1937.

The authors have devised two types of apparatus which operate essentially as follows: the gasoline is caused to ascend in a capillary tube after passing through a copper spiral surrounded by a water bath which is theromostatically maintained at various temperatures. During a test the gasoline flows up the capillary tube under a constant suction pressure equivalent to a column of water one meter high, and note is taken of the temperature at which bubbles of vapor appear in the capillary tube.

Choice of a Turbine Oil and Its Care During Operation—Gustav Baum, before second world petroleum congress, Paris, June, 1937. oel und kohle, vol. 13, p. 736.

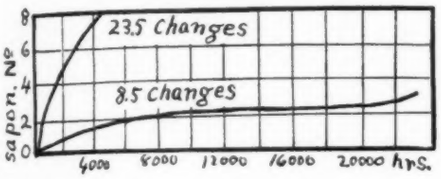
In practically all countries precise specifications have been established governing purchase and acceptance of lubricating oils for power machinery, including turbines. These specifications relate almost entirely to purity and viscosity tests and sometimes to aging tests, which are really among the most important of all. After passing these tests the subsequent behavior of a turbine oil will reflect the care bestowed on it by the user. How an oil will stand up in operation will depend to a large and mostly unappreciated extent on the construction of the turbine and on the pains taken to keep it clean and to protect it from outside influences.

An important question is, when has a turbine oil deteriorated to a point where it should be changed? It now appears that the limit of usability is a neutralization number of 3, or a saponification number of 6. From the standpoint of the consumer it is important that this time should be as long as possible and it is a fact that, with a properly refined oil, the matter of its life is in the hands of the consumer himself. Not so many years ago in Germany it was agreed that a turbine oil should be changed after 8,000 operation-hours; this was later raised to 20,000 hours, and at the present time there are turbines in Germany wherein the oil has lasted more than 80,000 hours. For all practical purposes this is nearly an eternal durability, the only expense being to make up oil lost by evaporation or splashing.

What has brought about this increase of oil-life from 8,000 to more than 80,000 hours? It has not

come about because of any improvement of turbine oils themselves, but is due solely to the introduction of strict control and care of the oil, and to constructive improvements of the turbines.

One of the important points in the lubrication of a turbine is the quantity of oil in circulation. Here there is great variation; the charge of oil in several hundred turbine installations was found to range from 75 to 1600 grams per kilowatt capacity. Similar variations have been found in the rate of circulation of the oil, that is, the number of times the oil passes through the machine per hour; here figures from 4.3 to 28 have been noted. It has also been noted that the rate of deterioration of the oil, as indicated by the saponification number, is greatly affected by the rate of circulation, as may be seen from the accompanying diagram where the increase of the saponification number is plotted against operating-hours for two rates, 23.5 and 8.5.



The rate of deterioration of the oil is further affected by its temperature. No oil can stand up when exposed to the oxygen of the air at temperatures around 70 deg. to 75 deg. C. (158 deg. to 170 deg. F.). Hence, in the interest of a long life of the oil it is desirable to cool the oil at some point in its circuit; the temperature on leaving the cooler should not exceed 40 deg. C. (104 deg. F.).

Again, good filtration should be provided to keep the oil from being fouled by dust, floating fibres, water and other mechanical impurities.

ECONOMICS

Increase in World Motor Car Production—Oskar Tokayer, in PETROLEUM PRESS SERVICE, vol. 4 (1937), No. 36, p. 440.

General improvement in economic conditions during the first six months of 1937 is reflected in the increased activity of the motor industry. World motor car production rose from 3,221,000 units in the first half of 1936 to 3,601,000 units, or by 11.8 percent. All the major producing countries participated in the expansion:—

Motor Car Production—January to June

	1937 Units	1936 Units	Increase Percent
U. S. A.	2,790,420	2,500,610	11.6
Great Britain	273,533	253,653	7.8
Germany	156,711	149,659	4.7
Canada	128,371	105,948	21.1
France	113,000	110,000	2.7
Russia*	92,000	66,000	39.4
Italy	32,300	19,200	68.2

*Estimate.

Increase in American production has fallen somewhat short of expectations, in consequence of labour troubles at the beginning of the year, while higher working costs and prices have also not been without an adverse effect. Output of passenger cars, at 2,286,520, was 476,780 units below the 1929 record, though truck production, at 503,900 units exceeded the 1929 figure by 52,390. In spite of the price increases which may be expected for most types of vehicle, American output is expected to reach 5,200,000 units for the twelve months, and the former peak figure of 5,358,000 vehicles, reached in 1929, will be approached.

Production in Great Britain, which has shown a steady increase for several years, has maintained this tendency, which indicates the economic improvement in the country. In Germany, there has been a falling off in the rate of increase owing to shortage of raw materials. The industry has been compelled to concentrate on the export market, with the result that the domestic trade has suffered accordingly.

Smallest increase in production is that of France, with 2.7 percent. The improvement in sales which resulted partly from devaluation, and partly from genuine trade revival, has not lasted long. The check to further buying has been due, in no small measure, to the heavy taxation of petroleum products, and the effect on motor traffic of the co-ordination regulations in the interest of the railways.

Though there has been a marked increase in Russian motor car production, the results are disappointing when compared with the planned figures. The erection of new automobile factories at Jaroslawl, Kuybischew and in Siberia, and reconstruction of the works in Moscow and Gorky, were expected to result in the production of 630,000 units in 1937, against 160,500 in 1936. Later estimates put the year's total production of motor cars at 220,000 units, but even this figure was reached to the extent of only 42 percent during the first six months.

GENERAL

Heavy Water (Heavy Hydrogen) in Petroleum—A. Maillard, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

The author has estimated the deuterium present in samples of gasoline of two different origins by combustion of a sufficient quantity of the gasoline to give twenty litres of water as product of combustion, followed by concentration of this water by electrolysis to a volume of 5cc., then determination of the refractive index and freezing point.

For purposes of comparison, twenty litres of conductivity water were treated in an identical manner. Results obtained were as follows:

If we assume that the concentration of deuterium in ordinary water is one part in 4,000, that of the water from gasolines from Pechelbronn and Peru contained respectively one part in 1,920 and one part in 2,500.

It follows for the original spirits that the respective deuterium contents are 0.94 parts per 1,000 and 0.72 parts per 1,000. Estimations are being carried out on gasolines of other origins.

Iron Phosphate as Anti-Corrodant—M. G. Verhey, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

Formerly steel was protected principally by many coats of ordinary oil paint, without much attention being paid to the pretreating of the surface of the steel. Rust under the paint was regarded as a necessary evil. Scraping, touching up and repainting cost a great deal of money.

At present a coat of iron phosphate is generally substituted for the mill scale in an increasingly cheaper way and it is protected by a small number of coats of paint, containing an exceptionally strong and appropriate binder with great adhesive properties. Rust under the paint is avoided and only the top coat of paint ages and requires occasional painting over.

Structure and Origin of Clays Suitable for Decolorizing Mineral Oils—Jacques de Lapparent, before SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

The author sets up a classification of decolorizing earths based on their mineralogical characters. Decolorizing earths are argillaceous earths of which the essential constituent is one of the three clay minerals: kaolinite, attapulgite, montmorillonite, or a mixture of these. Activity, or the possibility of being activated, of any of these minerals depends on its structural formula, and this structure is determinative irrespective of the nature of the earth.

Kaolinite is active or activatable only when its formula is that of anauxite:

$$(OH)_4 \cdot Al_{2-x} \cdot Si_{3-1\cdot x}\,(OH)_{2\cdot x}$$

X being the number of Al ions subtracted from the theoretical kaolinite. Montmorillonite loses its active property when heated to a temperature that destroys the (OH)SiMg radical. When raised to the same temperature attapulgite does not break down in this way. The rest of the paper discusses the geochemical origins of these earths.

BOOKS

Standardization of the Methods of Calculating Petroleum Statistics—by Mihail Pizanti. Published 1937 in English and French by MONITEUR DU PETROLE ROUMAIN, 1937, for presentation to the SECOND WORLD PETROLEUM CONGRESS, Paris, June, 1937.

In this brochure a petroleum economist and publicist registers his dissatisfaction with the present confusion in the world's figures on oil production and trade. The main trouble-maker is the habit in some quarters of regarding seven barrels as the equivalent of one ton of oil without regard to the average specific gravity. In a specific case, certain statisticians, by dividing the number of barrels by 7, reached the figure 9,076,000 tons as Roumania's crude oil production in 1936, whereas the real figure is 8,704,000 tons, making a plus error of more than 4.2 percent. Further difficulty arises from the fact that when volume is converted into tons different authorities employ different figures for average specific gravity. The American Petroleum Institute recommends 0.8600, which would make the barrel equivalent to 136.7 kg. or 7.3 bbl. to one metric ton. From the author's research into the matter he concludes that the figure for average specific gravity should be 0.8610, which would make the barrel equivalent to 137 kg., and he ends with a plea for international cooperation for establishing world wide statistical uniformity.

Petroleum Technology in 1936—edited by F. H. Garner. Published 1937 by INSTITUTION OF PETROLEUM TECHNOLOGISTS, London, 326 pages, price 7s. 6d.

In 1924 the I.P.T. inaugurated a series of annual reviews of progress in the oil industry in the form of surveys of new publications in the various sections of petroleum technology, each written by one or more persons familiar with developments within the section.

The present volume, which is the second of the annual series to be published in book form, mirrors the current developments of the oil business in 25 aspects, as follows: Geology of Petroleum; Regional Geology and Development; Geophysics; Production; Drilling; Transportation and Storage; Ocean Transport; Chemical and Physical Refining; Cracking; Natural Gas, Natural Gasoline and Liquefied Petroleum, Gases; Light Distillates, White Spirit and Kerosene; Automobile Engines; Diesel Oil, Gas Oil and Heavy Fuel Oils; Oil Engines; Lubricants and Lubrication; Special Products; Asphaltic Bitumen and Road Materials; Analysis and Testing of Petroleum Products; The Chemistry of Petroleum; Hydrogenation; Motor Benzole; Synthetic Fuels; Low and Medium Temperature Carbonization and Retortable Oil-Yielding Materials; Petroleum Literature; Petroleum Statistics.

Within the space of 326 pages the authors manage to notice the contents of more than 2,200 articles, with the result that this volume is about 20 percent larger than its predecessor. Much of this increase is due to increased attention to alternative fuels (petroleum substitutes) from hydrogenation and other treatments of coal and other organic materials that are the source of synthetic fuels in various countries. The name and subject indexes are extensive, and altogether the book is valuable for reference.

INTERNATIONAL NEWS

And Reports

JAPANESE OIL SUPPLY UP 22.7 PERCENT

SUPPLY of petroleum products in Japan during the first half of 1937 increased by 22.7 percent over the supply in the corresponding period a year ago. Domestic production of refined products recorded an advance of 30.8 percent over a year ago. Imports of petroleum products in the period under review jumped 67.3 percent. The first-half supply of gasoline was up 21.5 percent, of kerosene, up 46.3 percent, of light oil, up 33.0 percent, lubricating oil, up 22.3 percent, and of heavy oil, up 20.4 percent over the supply in the corresponding period in 1936.

SUPPLY OF PETROLEUM PRODUCTS IN JAPAN

(First Half of 1937 in 1,000 gallons)

	First Half 1937	Increase Over First Half 1936
GASOLINE—		
Refined from domestic crude	17,090	6,640
Refined from imported crude	96,729	19,855
Imports	86,298	9,025
Exports	342	105
Total Supply	199,755	35,415
KEROSENE—		
Refined from domestic crude	9,453	4,180
Refined from imported crude	13,300	2,081
Imports	14,440	4,684
Exports	3,487	276
Total Supply	33,715	10,669
LIGHT OIL—		
Refined from domestic crude	12,322	5,672
Refined from imported crude	13,386	2,634
Imports	637	475
Exports	76	2,261
Total Supply	26,269	6,520
LUBRICATING OIL—		
Refined from domestic crude	12,464	3,375
Refined from imported crude	26,657	2,793
Imports	14,317	4,389
Exports	3,116	1,359
Total Supply	50,322	9,198
HEAVY OIL—		
Refined from domestic crude	18,563	2,052
Refined from imported crude	50,407	14,440
Imports	218,567	32,690
Exports	48	371
Total Supply	287,489	48,811
ALL PRODUCTS—		
Refined from domestic crude	69,892	21,919
Refined from imported crude	200,479	41,803
Imports	334,259	51,263
Exports	7,069	4,372
Total Supply	597,561	110,613

HUNGARIAN DRILLING

KOZGAZDASAGI ERTESITO, official organ of the Hungarian Ministry of Industry, gives the result of tests being drilled by Bukkszek, in the county of Heves, Hungary as follows, up to September 1, 1937:

Well	Depth in feet	Total oil produced (in barrels)
No. II	941	1,680
No. III	281	1,540
No. III/a	241	693
No. III/b	294	196
No. V	413	448
No. VIII	743	25

A total of 4,582 bbl. of oil was produced.

GUATEMALA CONCESSION

EXECUTIVE orders have been issued by the Ministry of Industry in Guatemala on October 1, 1937, authorizing exploration work on part of the 3,100,000 hectare concession belonging to Compañía Guatemalteca de Petróleo Shell. These orders apply only to exploration work; the area in which exploitation may be carried on will be determined later in accordance with the law.

BRITISH OIL IMPORTS

BRITAIN'S total petroleum imports for September, 1937, at 6,716,000 bbl., were slightly below those for the corresponding month of 1936 although, owing to the advance in prices, the c.i.f. value increased by £832,553 to £3,796,551. Oil imports for the first three quarters of the current year were 5.6 percent greater in volume than for the same period of last year, and showed a considerably larger increase over the 1935 figures.

Crude oil imports for September, 1937, were lower than those in the same month of 1936, due entirely to smaller receipts from Iran. There was also a considerable decline in imports of gasoline from that country, but a substantial rise in arrivals of Iranian fuel oil was observed. Lubricating oil imports rose sharply to 361,000 bbl. in September, and now show a small increase over 1936 for the expired period of the current year. United States remains principal supplier of this product, with Russia next in importance, the figures of the two countries for the nine months being 1,822,000 bbl. and 305,000 bbl. respectively.

British Oil Imports by Products

(Barrels)

	September 1937	9 mos. to Sept. 1937	9 mos. to Sept. 1937
Gasoline	2,476,000	29,942,000	27,279,000
Kerosene	600,000	4,657,000	4,532,000
Gas oil	305,000	3,028,000	2,456,000
Lubricating oil	361,000	2,560,000	2,535,000
Fuel oil	1,699,000	15,113,000	14,459,000
Other sorts	36,000	331,000	361,000
Refined products	5,477,000	55,631,000	51,622,000
Crude oil	1,239,000	11,335,000	11,794,000
Total imports	6,716,000	66,966,000	63,416,000

GULF EXPORT PRICES FOR MAJOR OIL PRODUCTS

	Products	Sept. 21	Sept. 28	Oct. 6	Oct. 13	Oct. 20
		Cents Per Gallon				
GASOLINE:	U. S. Motor	6⅜	6	6	6	5⅞
	64/66-375 E.P.	6⅜	6¼	6¼	6¼	6⅛
	59 Octane and below	6⅛	6	6	6	5⅞
	65 Octane and above	6½	6½	6⅜	6⅜	6¼
AVIATION GASOLINE:	Gulf Export in cargo lots	9	9	9	9	9
KEROSENE:	44 w.w.	5⅜	5½	5½	5½	5⅜
	44/43 w.w.	5⅛	5¼	5¼	5¼	5¼
	41/43 p.w.	5	5⅛	5⅛	5⅛	5⅛
GAS OIL:	26-30 translucent	4⅛	4¼	4¼	4⅜	4⅜
	30 plus translucent	4⅜	4½	4½	4½	4½
		Dollars Per Barrel				
FUEL OIL:	Bunker C	1.05	1.05	1.05	1.05	1.05
	Cargo lots	0.92	0.90	0.87	0.87	0.85
	Diesel oil	1.90	1.90	1.90	1.90	1.90
		Cents Per Gallon				
LUBRICATING OIL:	Bright Stock No. 8	27½	25½	25½	25½	23½
	Bright Stock No. 6½	27	25	25	25	23
	600 Warren E	25	24	23	23	23
	600 Unfiltered s.r.	21½	20¼	18¾	17¾	17½
(New York Export Market)	650 Unfiltered s.r.	24	24	22½	22½	21½
	600 Flash s.r.	25	25	24	24	23½
	630 Flash s.r.	29	29	28	28	28
	Neutral 200 No. 3	32	32	32	32	32
	Neutral 150 No. 3½	27½	27½	27½	27½	27½
(South Texas Export Market)	Red oil 500 No. 5-6	8½	8½	8¾	8¾	8¾
	750	9¼	9¼	9¾	9¾	9¾
	1200	9¾	9¾	9¾	9¾	9¾
	Pale oil 500	8½	8½	8½	8½	8¼
	750	9¼	9¼	9¾	9¾	9¼
	1200	9¾	9¾	9¾	9¾	9¼
		Dollars Per Barrel				
CRUDE OIL:	East Texas delivered at Gulf for export	1.53½	1.53	1.53	1.53	1.51

FREIGHT RATES

	Sept. 21		Sept. 28		Oct. 6		Oct. 13		Oct. 20	
	Dirty	Clean	Dirty	Clean	Dirty	Clean	Dirty	Clean	Dirty	Clean
	Shillings Per Ton									
Gulf—U.K./Continent	24/–	26/9	24/–	25/3	24/–	25/3	24/–	25/3	24/–	24/–
California—U.K./Continent	—	—	—	—	no booking		—	—	—	—
Aruba—U.K./Continent	21/6	22/–	21/6	22/–	21/6	22/–	21/6	22/–	20/–	21/–
North Atlantic—U.K./Continent	22/–	24/–	21/–	21/3	21/–	21/3	21/–	21/3	20/6	20/6
	Cents Per Barrel									
California—North Atlantic	—	—	—	—	no booking		—	—	—	—
Gulf—North Atlantic	30	35	28	32	28	32	28	32	27	30
Venezuela—North Atlantic	30	—	30	—	30	—	30	—	30	—
Tampico—North Atlantic	40	—	40	—	40	—	40	—	40	—
Curacao—North Atlantic	34	33	30	30	30	30	30	30	30	30

Among new Dowell developments is the compound treatment bringing the production boosting benefits of *Inhibited* Acidizing to tight and impure formations. Once again Dowell demonstrates its ability to meet unusual conditions by devising special methods and technique.

Among the interesting methods of American oil production were the efforts of Roy L. Jones and E. M. Carter, of Wichita Falls to mine oil at Electra, Texas in 1925. Sinking a shaft 108 feet to the top of the sand body, a drift was driven some 15 feet. The shaft was then deepened another 20 feet and a second drift of 60 feet run under the pay. Daily production averaged 60 barrels. Unprofitable in comparison with present low cost drilling, this experiment proved the possibility of mining as a secondary recovery method in shallow pays.

DOWELL*

*Registered U. S. Patent Office

DOWELL INCORPORATED · *Subsidiary of THE DOW CHEMICAL COMPANY* · *Executive Office:* MIDLAND, MICHIGAN · *General Office:* KENNEDY BUILDING, TULSA, OKLAHOMA
IN MEXICO . . . DOWELL SOCIEDAD ANONIMA, Apartado 2424, Mexico, D. F., Mexico · Tampico, Tamaulipas, Mexico

ADA, OKLAHOMA — *PHONE, WRITE OR CALL AT ANY OF THE FOLLOWING OFFICES* — BORGER, TEXAS
CALGARY, ALBERTA · CODY, WYOMING · EUREKA, KANSAS · GREAT BEND, KANSAS · HAYS, KANSAS · HOBBS, NEW MEXICO · LAWRENCEVILLE, ILLINOIS · LONG BEACH, CALIFORNIA · Mc CAMEY, TEXAS · MIDLAND, TEXAS · MT. PLEASANT, MICHIGAN · NEWTON, KANSAS · OKOTOKS, ALBERTA · SEGUIN, TEXAS · SEMINOLE, OKLAHOMA
SHELBY, MONTANA · SHREVEPORT, LOUISIANA · STAMFORD, TEXAS · STONEWALL, OKLAHOMA · TULSA, OKLAHOMA · WICHITA, KANSAS · WICHITA FALLS, TEXAS

OIL AND GAS WELL CHEMICAL SERVICE

Sovfoto

Preparing to run 8-inch casing at Baku, U.S.S.R.

U. S. S. R.

J. WEGRIN

Official Figures for Soviet Oil Operations

	Crude Production (Bbl.)	Daily Average (Bbl.)	Run to Stills (Bbl.)	Drilling (Ft.)
January	16,117,461	519,918	14,412,330	443,310
February	13,796,325	492,726	12,671,478	399,317
March	15,907,051	513,130	14,375,151	540,510
April	16,401,771	546,722	14,386,086	541,300
May	18,130,230	584,846	16,097,778	591,510
June	17,953,812	598,460	14,790,000	580,000
July	18,580,752	599,379	14,790,000	585,000
August	15,830,000	527,667	14,790,000	580,000
September	16,663,000	537,516	15,100,000	530,000
Total 9 Months, 1937	149,380,392	547,181	131,412,823	4,579,037
Total 9 Months, 1936	148,073,210	544,387	134,968,204	5,036,511
Total 1936	199,634,921	545,450	180,582,274	6,958,916
Total 1935	184,007,619	504,130	152,783,726	4,858,445
Quota 1937	234,450,000	642,329	208,285,000	9,240,000
Quota 1936	222,345,000	607,500	182,250,000	7,100,000
Quota 1935	221,106,000	605,769	178,605,000	5,214,000

producing wells in Russia, and that of the wells to be rehabilitated only 400 have resumed production.

According to original intentions, the Second Piatiletka was to effect a number of improvements in the producing and refining divisions of the oil industry during 1937, and new records were to be established in drilling, output and run to stills. General trend towards greater industrialization of the country, mechanization of agriculture, widespread transportation, and strengthening of the nation's defense forces were the factors which necessitated these further increases—which policy is to be continued in the Third Piatiletka, now being developed.

Due to the difficulties under which it labors it has become increasingly difficult to force expansion of the oil industry, and it

(Continued on page 58)

DRILLING speed per table month at Baku should have been at least 3,300 ft., according to plans made at the beginning of 1937, but speeds actually attained in practice have been appreciably less than anticipated—the latest figure available, that for September, was 1,800 ft. and is a decline from the previous month. Likewise, it was intended that during the current year 2,100 new wells should be drilled and brought on production—whereas statistics for the first nine months of 1937 indicate that it is extremely unlikely that the required number of wells will be completed by the end of the year.

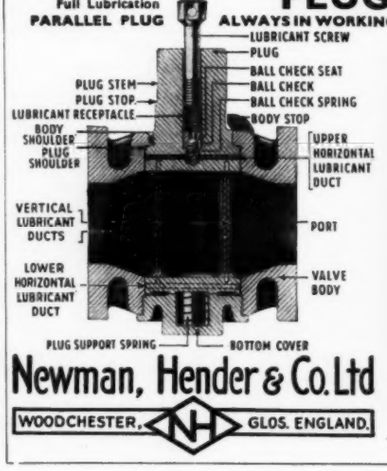
These new wells, together with 1,500 idle wells which were to be re-equipped and brought back on flow, were to make a total of 12,000 operating wells in Soviet oilfields. Latest details are that there are only 8,000

NEWMAN-MILLIKEN GLANDLESS LUBRICATED PLUG VALVES

Visual check on Full Lubrication PARALLEL PLUG

Suitable for Pressures to 3,000 lbs. per sq. in.

ALWAYS IN WORKING CONTACT WITH ITS SEATING. NO GLAND. NO PACKING



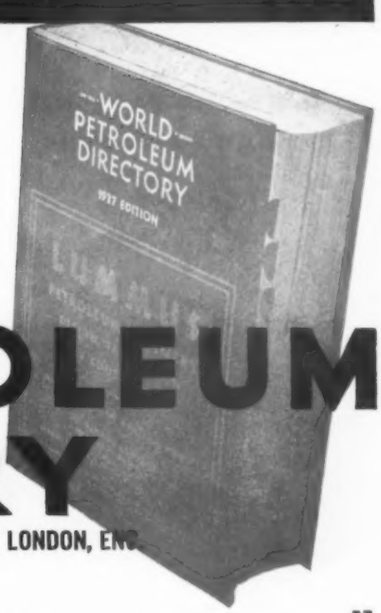
Newman, Hender & Co. Ltd

WOODCHESTER, GLOS. ENGLAND.

Installation showing N-M Valves on Gasoline Storage Tanks

Don't let the days fly by—

Order Your Copy now
1937 Edition $10.00



WORLD PETROLEUM DIRECTORY

56 W. 45th ST., N.Y.C. • 412 W. 6th ST., LOS ANGELES • 3 SAVOY PL., W.C.2, LONDON, ENG.

LINK-BELT
Vibrating
SCREENS

for RECONDITIONING ROTARY MUD

• Tried and proved . . . for reconditioning, degassing, cleaning and maintaining uniform weight of mud. Successfully used in oil fields throughout the world. Send for Folder No. 1772.

LINK-BELT COMPANY
Woolworth Bldg., New York City
Philadelphia Los Angeles
Dallas Tulsa Houston

Export Distributors
OIL WELL SUPPLY CO.
New York London
For All Countries Throughout World Except
Argentina — General Electric, S. A.
Buenos Aires
Venezuela and Trinidad
S. B. Schnitter — Port of Spain, Trinidad
7057

LEACH EXCHANGERS
for
High Temperatures
High Pressures

Fracto Control

High Heat Transfer
Low Vapor Pressure Drop
Long Tube Life
Easy Cleanability

Leach Exchangers are fully protected by U. S. and foreign patents

C. H. LEACH CO.
117 Liberty St. New York

(Continued from page 56)

has therefore been found necessary to revise plans downwards repeatedly. An example of such revision is that of crude production; originally planned to be about 520,700,000 in 1937, the program is now aimed at 234,450,000 bbl. for the year. It is evident that not only will any increases in the three main divisions of the oil industry be of a minor nature, but that 1937 will possibly compare rather unfavorably with the previous year.

Apart from failure to fulfill plans, another problem which is harassing the Soviet government is that of waste. Loss of fuel in storage, transportation and consumption is wasting large quantities of petroleum products. Annual loss of gasoline by evaporation is estimated to be more than 4,100,000 bbl. IZVESTIA, dated October 2nd, states in an editorial that one of the outstanding advantages of socialist economy is the effective utilization of material resources at its disposal, and that therefore the irrational waste of fuel in all Soviet industries is tantamount to criminal squandering of national wealth.

Requirements put up to the strained oil industry, continues the editorial, are more than it can fulfill. As a result it has been necessary to demand greater rationalization of fuel consumption. Oil consumption was to be reduced by 12 percent during 1937, but losses continue due to lack of insulation of steam pipes, boilers, etc., as well as improper handling. IZVESTIA warns that winter is approaching and that unless steps are taken in time to overcome these difficulties that the situation will be serious.

No improvement has been reported in the operation of the Soviet oil industry at the close of the third quarter of 1937. All three main divisions are below plan, as well as below the corresponding figures of operation for the same period of the previous year. During the nine months plan fulfillment in production has been about 65 percent, slightly more in run to stills, while drilling was only 50 percent of plan. So great are the arrears in the oil industry that it would be necessary to produce more than 72,900,000 bbl. of crude in order to approach the year's quota, but such an improvement is unlikely to be effected.

According to plan for 1937 and 1936 the Soviet oil industry had to produce approximately 58,612,000 bbl. and 55,586,000 bbl. per quarter, respectively. The actual figures of production during the first three quarters were as follows:

Soviet Oil Production

	1937	1936
	Barrels	
First quarter	45,820,837	48,768,101
Second quarter	52,485,813	48,986,801
Third quarter	51,073,752	48,848,832

(Continued on page 60)

TANK FIRES *can be* PREVENTED

. . . with Oceco Flame Arrestors. Accepted standard world-wide throughout the industry, they are being used on more than 250,000,000 bbls. of tankage — yet, even when located in the middle of a blazing tank farm —

NO TIGHT TANK EQUIPPED WITH AN OCECO FLAME ARRESTOR HAS EVER BEEN LOST BY FIRE

Let us send you full details. It will pay you to get the advantages of Oceco Engineering!

OCECO *Fittings*
THE JOHNSTON & JENNINGS CO.
OCECO DIVISION
891 Addison Road • Cleveland, Ohio
Engineering and Sales Services: NEW YORK • CHICAGO • PITTSBURGH • HOUSTON • TULSA • OKLAHOMA CITY • LOS ANGELES • OAKLAND, CAL.

SPECIFY OCECO FITTINGS . . . YOUR TANKS DESERVE THE BEST

PROVED IN THE OIL FIELDS OF THE WORLD

AQUAGEL
The Ideal Mud Conditioner

Properly conditioned with a small amount of **AQUAGEL**, native clays will have wall-building properties which prevent caving of holes, stuck drill pipe and casing. Drilling mud prepared with **AQUAGEL** reduces abrasion, prevents cuttings from settling, seals off crevices and insures the landing of casing without sticking.

STABILITE
An Improved Chemical Mud Thinner

STABILITE reduces the viscosities of thick drilling muds without destroying their wall-building properties. **STABILITE**-treated muds quickly release gas from gas-cut muds and are of particular value where weighing materials are used, or in drilling through heaving or caving formations. **STABILITE** assures lower mud-treating costs.

BAROID SALES DEPARTMENT
NATIONAL PIGMENTS & CHEMICAL DIVISION
NATIONAL LEAD COMPANY
BAROID SALES OFFICES - LOS ANGELES - TULSA - HOUSTON

S&L

'S & L' TUBES FOR THE OIL INDUSTRY

Line pipe, casing, drill pipe, as well as all types of specials, manifolds, etc., required for refinery work are regularly supplied by us to the leading oil companies.

The high grade quality of 'S & L' Products is ensured by rigid supervision during each process of manufacture. This supervision begins at the beginning with the raw materials and is exercised at every stage of production from the ore to the finished pipe.

Send for a copy of our 'O' catalogue No. 461.

STEWARTS AND LLOYDS LTD.
GLASGOW BIRMINGHAM LONDON

SULPHURIC ACID

Recovery, Production, Concentration

New construction and remodeling
to meet refinery needs

Chemico Sludge Conversion Plants for recovery of strong clean acid direct from raw untreated sludge
Chemico Acid Production Plants
Acid Separators and Concentrators

Consultation, design and erection
with performance guaranteed

Chemical Construction Corporation

30 Rockefeller Plaza,
New York, N. Y.
Cables:—Chemiconst, New York
European Representatives:
CYANAMID PRODUCTS, LTD.
14 Finsbury Circus, E.C.2, London, England

CHEMICO PLANTS are PROFITABLE INVESTMENTS

RENOLD

Designed and made to A. P. I. specification by the world's leading driving chain makers.

Send for leaflet No. 216/32

THE RENOLD & COVENTRY CHAIN CO., Ltd.
MANCHESTER, ENGLAND
Agents throughout the world

(Continued from page 58)

Fulfillment of planned crude oil production for the nine months amounted to 83 percent for all Russian oilfields, and 86 percent for September. Fulfillment by individual fields is given in the accompanying table.

Plan Fulfillment by Russian Oilfields in September

Field	Low	High
	Percent	
Baku	94.0	95.0
Grozni	70.0	86.0
Maikop	89.0	114.0
Bashkiria	39.0	50.0
Emba	66.0	70.0
Voroshilov	30.0	50.0
Kalinin	58.0	75.0
Turcomaneft	82.0	110.0
Sakhalin	90.0	93.0

Although the Soviet press still blames arrears in planned production against the work of saboteurs, efforts have been made recently to improve operation of the industry. Individual fields in the Baku group have brought in wells during August and September which increased total output of the group to 455,500 bbl. daily, but this is still 22,500 bbl. below plan. Apart from Asisbekov and Kaganovitch, Baku fields are appreciably in arrears.

Efforts have been made to increase production at Grozni, while the Achisu, Kayakent and Izerbash of Daghestan have been taken away from Grozneft and made into an individual group responsible to Glavneft. This, it is hoped, will contribute to more advantageous development. Similar developments have been made at Emba, while further producers have been obtained in Middleasia, Turcoman and the Volga region.

Soviet Oil Exports

Product	January-July 1937 Tons	Rubles
Crude oil	47,897	1,754,000
Gasoline	257,377	27,034,000
Kerosene	165,992	13,451,000
Lubricating oil	117,604	14,704,000
Diesel oil	5,682	213,000
Gas oil	236,357	14,120,000
Fuel oil	395,069	14,758,000
Asphalt and others	2,823	274,000
Paraffin	5,655	2,520,000
Total 7 months	1,234,456	88,828,000

Imports of gasoline into U. S. S. R. from U. S. A. during the first seven months of 1937 were 70,665 tons valued at 7,883,000 Rbl.

Aviatop, the organization comprising all Soviet refineries outside of Baku and Grozni, has appointed N. I. Kokurin as head of the organization. Kokurin succeeds M. Batulin, who has been declared a saboteur and enemy of the people. Another change in management was the appointment of J. S. Shirokv and V. N. Belenki as assistant heads of Glavneft.

AUSTRIAN CRUDE OUTPUT RISES

DURING the first seven months of 1937 the crude oil production of Austria amounted to 141,330 bbl., or almost three times as much as the annual output in 1936 and more than was produced during the five years 1932-1936. If production continues at this daily average of 667 bbl., the year's output will be about 243,500 bbl.

STRAIGHT TALK.... about CROOKED HOLES

Write for literature

Sperry-Sun Well Surveying Company
1608 Walnut Street, Philadelphia, Pa.
425 Petroleum Building, Tulsa, Okla.
3118 Blodgett Avenue, Houston, Texas
549 East Bixby Road (3800 Block—Atlantic Ave.) Long Beach, Calif.
Bank of Lafayette Building, Lafayette, La.
c/o Elks Club, 17th and I Streets, Bakersfield, Calif.

STORAGE TANKS

any capacity
for OIL, PETROL, ETC.
ELECTRICALLY WELDED

We are experts in the designing, manufacture and erection of Electrically Welded Tanks.

COMPLETE INSTALLATIONS

Send us your Enquiries

OXLEY ENGINEERING CO. LTD.
LEEDS 10, ENGLAND
Telephone: LEEDS 27468 Telegrams: OXBROS LEEDS
LONDON OFFICE: Winchester House, Old Broad Street, E.C.2
Telephone: LONDON WALL 3731-3732

Gracious Living

Hay-Adams House continues the traditions of the famous names which it perpetuates—the charm, the dignity, the inborn graciousness of gentility—yet mindful always of the demands of the present day—for example, Hay-Adams House is

COMPLETELY
Air Conditioned

RATES FROM $3 SINGLE $4.50 DOUBLE

HAY-ADAMS HOUSE

Opposite the White House
Overlooking Lafayette Park
WASHINGTON, D. C.